Engineering Record

A Weekly Journal Devoted to Civil Engineering and Contracting

Published by McGraw Publishing Company, Inc.

Volume 73 NEW YORK, SATURDAY, APRIL 22, 1916 Number 17

Extravagance in Passenger Terminals

ANENT the charge often made against the railroads of extravagance in large passenger terminals, Robert Trimble of the Pennsylvania system, retiring president of the American Railway Engineering Association, presented some interesting figures regarding the proposed Union Station in Chicago at the recent convention in that city. Of the $50,000,000 estimated cost of that terminal, he stated that in round numbers $35,000,000 must go for land, regardless of the structures placed upon it; $5,000,000 for street changes and changes in other public facilities, and $5,000,000 for tracks, signaling, power plant and the like, leaving only $5,000,000 for the headhouse and concourse. Mr. Trimble admitted that by making these structures, which constitute what the public regards as the station, strictly utilitarian it might be possible to save $2,000,000 of the $5,000,000. He thought, however, that the $2,000,000 was justifiable advertising. And it appears to this journal that an expenditure of 4 per cent extra in so large an undertaking for the beautification of the work and the comfort of the railroads' patrons is not an inordinate expenditure. Mr. Trimble merely presented from a different angle a fact that this journal has pointed out, that the buildings, however monumental, are only a part of a large railroad station. Nobody will deny that the Union Station in Chicago needs to be replaced. It would be the height of folly to replace it with a plant just able to meet present needs. Ordinary foresight demands a layout that will serve for a long time to come, and there would be abundant criticism if the railroads concerned should make the prominent parts anything other than a credit to the city.

"Saving New York"

ATTENTION was called in the Engineering Record of March 11 to the movement under way in New York to keep manufacturing out of the section now occupied by the clubs, hotels, theaters and high-class retail-shopping establishments. The plan is to bring pressure upon the women's-clothing manufacturers—the offending parties—by the retail establishments, whereby these stores promise to favor those whose factories are outside of the zone it is desired to restrict. It is astonishing to see the support which this privately managed "city planning" movement is receiving, and also to note the attention that the proposal is receiving outside of New York. The plan has been favorably received and if it results successfully, as is sincerely hoped, should become the forerunner of similar movements elsewhere. On the face of it, it may appear unjust to those whose establishments are already in the forbidden district. Such, however, is not the case, for ample time is given them in which to move their establishments. Furthermore, their prosperity is directly dependent upon that of the big retail establishments, whose success is going to be considerably curtailed if the manufacturing centers continue to close in upon them. If the plan is a success the manufacturers now directly affected will be certain to profit from the preservation of the high-class character of New York's retail section. The movement is well worth following closely, for it offers a procedure for industrial restriction which can be made effective even though laws aiming at the same result cannot be secured.

Filters and Finances

DESPITE board-of-health reports and typhoid epidemics which take their yearly toll, some cities are so tied up with water-company franchises and finances that little or no relief can be obtained in any reasonable time. At the little town of Monroe, Mich., at the western end of Lake Erie, filtration is the only practicable procedure because the sudden and enormous fluctuations of pollution are so great that only laboratory control of a chlorine plant could meet them. The town is too small to warrant the expense of a laboratory. Even then, granting that it would not produce objectionable odors and tastes, chlorine can only sterilize. It cannot clean water. In consequence the citizens resort to polluted wells. The financial difficulties in Monroe, like those in many another small town, are controlling. The company's charter provides that no franchise agreement can be entered into until within one year before the date of the charter's expiration, Jan. 1, 1919. In two years some marked change in the business relations between company and city may be expected. It would take over a year to build a plant, and the company does not feel that its present income is commensurate with the added expense of filters. To work out some satisfactory supplementary agreement is highly essential, but the state board of health has no power to force an adequate solution of the difficulty. Court procedure may offer hope, but one can never be certain as to the results. Furthermore, co-operation is always a better way out, when it is possible, than strife. Even without the power of insisting on some agreement, it should be the function of state boards of health to take the initiative in such cases. The welfare of the public demands it. An outside agency, moreover, frequently can bring about an agreement when the parties left to themselves can make no progress.

He Gave His Life

THIS month the "Bulletin" of the Iowa State Highway Commission contains a striking and well deserved tribute to A. E. Rommel, engineer of Mahaska County, who died in an attempt to break up an ice gorge which was backing up the water of the Des Moines River over valuable property for a distance of 10 miles. The work was known to be very hazardous, but Rommel, with not a thought of his own safety, assumed the responsibility. His mettle can best be judged by the fact that he went to his death after refusing to place his companion in greater peril after the two had hung for a time to a tree and after unsuccessful attempts to draw Rommel up into the branches. A tribute to him, in the following words, appears in the Oskaloosa "Times": "Was the effort ill advised? Was it the duty of the State to handle this situation? It matters not. There came a call for help. The board and its engineer heard the call and answered it. Rommel lost his life and the county the most capable engineer it is ever likely to secure. . . . Here was a man. His heart was in his work. The interests of the county were his interests. He worked night and day when the needs of the county required it, and found recompense in the knowledge of work well done. Absolutely square himself he frowned upon graft or deceit in any form. His work was an open book. The various contractors for the county knew him well, admired his ability and strove to carry out his plans." Possibly the administrators of the Alvord medal of the Western Society of Engineers may find that Rommel's widow should receive the award this year for service to the public in an inconspicuous manner. Such an award would indeed be a tribute to the man who did not hesitate at the call of duty.

Joint Sewage Disposal Project

THERE has just been made public the report of a board of engineers on a joint sewage treatment project for the cities of Pasadena, South Pasadena and Alhambra, Cal. The proposal contemplates an installation of Imhoff tanks, sprinkling filters and secondary sedimentation basins, but as considerable opposition to the location of the proposed works has arisen, it remains for the future to determine whether they will actually be built. One feature of the report, however, is of interest, because joint projects of this sort are by no means common. This feature relates to the proportioning of the cost of the works. The plan is to divide the expense on a pro rata basis according to the population of the three municipalities. This fact is of interest to those who recall the early history of the

Passaic Valley sewer in New Jersey, where the proposal to charge the several localities on the basis, not of the population, but upon the assessed valuation of their property succeeded in disrupting the plan. The California report states the case concretely when it says: "The outfall sewer and the purification works are designed to provide for the disposal of the sewage from a given population; consequently the proportioning of the cost and maintenance should be on a population basis." The combined populations of the three cities are given for the year 1916 and estimated at ten-year intervals until 1956. On the basis of the averages thus obtained Pasadena would be called upon to assume 66.3 per cent of the cost, South Pasadena 15 per cent and Alhambra 18.7 per cent. Putting this in round numbers, the board of engineers recommends a definite division of two-thirds, one-sixth and one-sixth respectively for the three cities for the first ten years, irrespective of minor changes in population which a later census may show.

False Economy

AN EXAMPLE of false economy in construction, resulting in the failure of an engineering structure, is illustrated by the washing out of an intermediate pier in the highway bridge over the Susquehanna River at Athens, Pa., on April 2. Two 185-ft. spans of the three-span steel superstructure were carried down by the gradual settling and failure of the pier, due to underscouring.

The bridge, constructed in 1914, replaced an old covered timber-truss structure built in 1840. The original timber-crib pier, filled with stone, supported the truss spans by a timber frame. About the year 1875 this frame was replaced by stone masonry, and the timber crib protected by means of riprap on the sides and lower end. When the new bridge was constructed it is understood that the county commissioners, to save expense, stipulated that the old piers should be used. A timber cofferdam was placed around the pier in question, about 4 ft. from it, and an attempt made to pump it out. This being found impossible, because water came up through the riprap, the concrete was poured between the cofferdam and the pier to form a jacket carried down to the top of the riprap. It is probable that a change in the action of the current was thus effected, causing a noticeable suction and whirlpool action on the downstream end which undermined the crib.

The county's engineer states that the formation of a gravel bar about 300 ft. downstream contributed to the deep scouring action. Even if that be the case, it does not lessen the emphasis which should be placed on the need of thorough examination of foundation conditions at suitable intervals and particularly when changes in the structure are contemplated. Such a study would probably have shown the necessity for careful safeguarding against scour.

It is stated that this is the second bridge lost by Bradford County because of improper foundations. A few more dollars spent on new piers or on a really effective reinforcement of the old piers would probably have saved the loss which must be assessed upon the public, and will be charged against the engineering profession.

Rational Selection of Road Types

THE selection of the type of road in far too many cases is beyond the jurisdiction of the engineer. The noteworthy attempt on the part of the engineers of the Illinois Highway Commission to put road-type selection on a scientific, economical basis, as described on page 536, is a step which all road enthusiasts should welcome. Road promotion in Illinois counties is going almost too fast for the county officials to keep up with it, and one of the most serious road problems now confronting the State is the danger that many counties will rush into bond-issue plans without as careful consideration of their individual problems as the magnitude and importance of the undertaking warrant. Bond houses will not, as a rule, finance engineering enterprises without having rational detailed plans before them, but for some reason they are not so particular when highway work is concerned.

The 1915 legislature gave the counties the right to select types of roads, including even state-aid roads. Concrete and brick roads are to be maintained by the state, gravel and macadam at the joint expense of state and county, and earth roads at the expense of the county. Bond issues in series of not less than ten, nor more than twenty, years were authorized. Further, the state-aid allotment as it becomes available may be used to pay off bonds to the extent of one-half the cost of construction. This makes possible the construction of a whole county system within a short time. Therefore, the state officials are vitally interested in seeing that the county systems are economically planned.

No one would think of building a sewer system entirely of 6-in. pipe nor of 6-ft. conduits. Almost invariably some balance is sought between service required and benefits conferred. In laying out county highway systems Mr. Marr has followed this obvious line of reasoning. Evidently a road which carries but five vehicles per day ought not to cost as much as one having a traffic of 5000. The problem is not so simple as that, but the principal factors are ascertainable and the application not difficult, so that the correct answer, considering all available materials, is readily obtained, and the reasonableness of the choice obvious to the average man. A prominent consulting engineer recently stated that he never felt that he had earned his fee unless the facts had been so clearly stated that the recommended choice was perfectly obvious to his client. The Illinois method of county-road selection is based on this method of presentation.

In practice the road-system committee is furnished with cost tables and charts for different types of road, for different widths, with 1 to 5 miles haul, so that the estimates can be made up roughly without difficulty. The effect has been to arouse a healthy interest which leads to a system much more nearly correct than any biased haphazard selection.

The National Industrial Inventory

THE naming, this week, of the members of the Naval Consulting Board's committee of engineers on industrial preparedness will serve to focus more than the usual amount of attention upon the current installment of Major Bond's series of articles, outlining the chief elements of a plan for mobilizing the nation's resources as a measure of national defense—the very problem which the committee has begun to solve. Too much importance cannot be attached to this feature of the national-defense plan. General Wood and other military authorities, in almost every address they have made for months past, have dwelt upon its significance and have pointed out that engineers are the men best qualified to perform this service. This fact President Wilson appreciated when he called upon the five national engineering societies — civil, electrical, mining, mechanical and chemical— to take charge of the work.

That the nation-wide industrial inventory, by states, will be conducted with speed and thoroughness is certain, for it is in hands of men of the highest professional standing, selected with care on the sole basis of fitness for the task in hand. As Major Bond points out in this issue, there has been hardly a military campaign in the history of the world in which the belligerents have not been hampered by a shortage of ammunition and supplies. Thus it is essential for the newly formed committee not merely to tabulate the country's manufacturing plants, with their personnel and output, but to arrange with the heads of these works for the actual production, in time of peace, of samples of the supplies which they would be called upon to furnish in case of war. In this way each manufacturer will have ready, on a small scale, trained men and machines for the particular service assigned to him.

Is a Plumber an Engineer?

THE QUESTION here used as a title may bring a smile to the lips of readers. Yet, in Indiana, it has a practical bearing. Some time since the Indiana State Association of Master Plumbers decided to change its name to that of the Indiana Society of Sanitary Engineers. Questioned as to the change, a prominent member of the plumbers' society stated that the master plumber had long ago outgrown his name. "He is called upon," so the gentleman says, "to engineer practically all installations of sanitary appliances pertaining to a building, and he is worthy of a higher degree than the simple name heretofore allotted him." With locomotive drivers going by the name of engineer, with plumbers posing as sanitary engineers, with business engineers and advertising engineers all about us, the term engineer promises to become as much abused as that of "doctor" or "professor." The way to stop the abuse does not now present itself. Certainly it is a matter worthy of the consideration of engineers generally, and particularly of engineering societies.

One can well question whether in the Indiana case the Indiana Engineering Society and the Indiana Sanitary Association are not somewhat at fault. The master plumber above quoted professes that he has never heard of either organization. Judging by the tone of his letter he cannot be classed with the ignorant, and the question therefore presents itself whether the Indiana Engineering Society and the Indiana Sanitary Association have taken a sufficiently important part in public affairs to impress themselves upon the people of their State. It is safe to assume that had they played a large part in public affairs, the gentleman in question—and many other master plumbers—would have heard of these associations. Moreover, the inference is fair that they would have conferred with these associations.

While there is much food for thought in the action of the Indiana plumbers, is there not reason, too, for questioning whether the engineers no less than the plumbers should bear some responsibility for the action?

The general question of restricting the use of the term "engineer" is discussed by N. M. Stineman in an article on page 546, which applies directly to the case of the Indiana plumbers.

The Conference on Engineering Co-Operation

ENGINEERING co-operation was in the heart of every man who attended the second conference of the Committee on Engineering Co-operation in Chicago last week. Fifty engineers, from more than forty societies, talked over the activities which are making their organizations of increasing service to their members and to the profession.

Isham Randolph put the spirit of the conference into words: "Let us have a central organization—call it what you will—which has no authority to command, but which has ears to hear and the voice to be heard. Let those ears be open to every plea or promise of common good, and let that voice go out to all affiliated bodies, carrying this plea or this promise for the common good. Let us come together at least once a year and feel that 'touch of nature which makes the whole world kin,' and growing out of that kinship let us consider and do those helpful things which will bless our comrades and overflow with helpfulness to our country and our kind."

Little legislation was attempted, a remarkable thing, for seldom do American citizens get together, no matter how informally, without proceeding to pass resolutions. The offering of an opportunity to the participating societies of defraying the expenses of the committee, and the establishment of a sub-committee to present to a third conference a plan for bringing about co-operation upon matters of common interest formed the sum total of concerted action.

The real success of the conference and the real benefit come in the exchange of ideas as to how the various societies were justifying their existence and were proceeding in the three matters of publicity, employment and legislation. Cleveland took away the prize for publicity methods. Within a few hours after the arrival of its efficient secretary, front-page items relating to the conference appeared in one of Chicago's metropolitan dailies. Furthermore, an interview with the Associated Press manager indicated that he wanted engineering matter, but, of course, he had specifications. Cleveland engineers get publicity. They have the formula and it works. There is no reason why it cannot be applied elsewhere.

One of the younger Chicago organizations has grappled most strenuously with the employment question, with the result of an estimated saving in the profession of $7,500 in the last six months. The idea of co-operative clearing houses in all large cities for engineers out of work is as yet a dream. No very workable plan has been devised. Some of the ideas expressed at the conference will no doubt bear fruit in a more detailed discussion at the next conference.

The efforts of the national societies' committee on engineering-reserve-corps legislation and of the naval consulting board are good examples of the necessity and advantages, professional and patriotic, of co-operation in matters relating to legislation. To get effective co-operation on legislation will always be difficult, except on the most obvious matters. With effective publicity methods in operation, however, both employment and legislative problems will be the easier to solve.

Engineering societies to which the ideas expressed at the conference will be brought back cannot help but have their future activities quickened and their ideals of service raised or confirmed.

The effort was well worth while.

One-Sided Contracts and the Engineer

THE one-sided contract, in which the engineer is the sole arbiter of his own work, is strenuously defended by engineers of the highest standing and competence. This is due not so much to experiences which may have shown that under no other form of contract can good work be secured, as to confidence in the legal strength of clauses, each of which has been tried in the white heat of legal actions and has not been found wanting. The intrinsic fairness of these clauses is seldom given much thought by these competent men, for they intend to use them not to oppose the contractor but merely to secure justice to their client. Unfortunately, all engineers are not actuated by the same high motives, and these one-sided contracts are used constantly to cover up the engineer's mistakes and incompetence.

Last week in an editorial entitled "Justice to the Contractor," the Engineering Record called attention to the contractors' side of the question. From the engineer's standpoint alone, however, there are equally weighty reasons why the profession should combine to produce a standard form of contract equitable to both parties. Some practical instances will help to emphasize the need.

There is at present at bar in an Eastern State a suit over a municipal contract, in which the city's counsel has repudiated the city's engineer over the correctness of a set of borings, maintaining that the engineer has no authority to assure their correctness. What does this mean? That this city, at least, does not think engineering service worth while in the very matter which is the basic reason for having engineering work done. If preliminary investigation and design are reaching such a low point of efficiency that they no longer save money for owners, what is left for engineers to do? The city referred to is not alone in taking such a position. Evidence presented to this journal indicates plainly that many owners, both private and public, have formed a similar low opinion of what the engineer can do to cheapen construction. As the engineer is paid in proportion to this estimate of him, does this not, in part, explain his low compensation? The evidence is also overwhelming that this condition is due to the admitted fact that the incompetent and the careless can pass for engineers without challenge.

Why is this true? Owners do not know what properly drawn contracts and specifications are. We have no standards which deal adequately with the business relations involved, or which make it plain that quantities should be accurately estimated and guaranteed. Owners do not know how much money a high type of engineering service will save. They do not know how much incompetent engineers cost them. Often they do not know until too late that their engineers are incompetent. Why? Largely because these same incompetents are, by American practice, made the final judges of their own mistakes. There being no adequate standards, how is the owner to discover that mistakes have been made? The so-called engineer covers his errors by throwing the cost temporarily on the contractor, who has no immediate recourse. Next time, however, the contractor adds to his bid on work handled by such an engineer, and the cost comes home to the owner. The owner does not analyze the situation, but he sees that he has saved nothing over his neighbor, who lets contracts direct to firms that do their own designing, and thereafter that owner is not apt to pay much for engineering work.

Is it not time to check a practice that results in such conditions by drawing up standard contracts that are two-sided and just from a business standpoint? They should provide that the engineer cannot unload his mistakes onto the contractor, and for an appeal in such cases to one or more men of the requisite experience, preferably named in the contract but who have no other connection with it.

The work must be undertaken by a strong engineering society, and none is in a position to do the work so well or to exercise as large an influence as is the American Society of Civil Engineers.

Rational Method of Selecting Types Evolved for a Comprehensive County Road System

Traffic Census, Population and Property Valuation Are the Bases Used in Equalizing the Cost—With These Relations Understood an Economic Selection Will Be Made in Most Cases

By WILLIAM W. MARR,
Chief Engineer Illinois State Highway Commission

BOND issues for county roads in Illinois are being promoted faster than comprehensive plans for construction on an economical basis can be developed. Under these conditions the State Highway Commission is exerting every energy, although hampered by lack of funds, to educate the county officials to the necessity of selecting road types (a prerogative given to the counties in 1915) by some rational system which will equalize the cost per year per user. As the basis for the selection in a broad, general way, the principal factors are traffic census, population and property valuation. Already experience has shown that with these factors laid down on large maps before county boards an economic selection of types will be made in the major portion of the counties.

SNAP JUDGMENT POOR POLICY

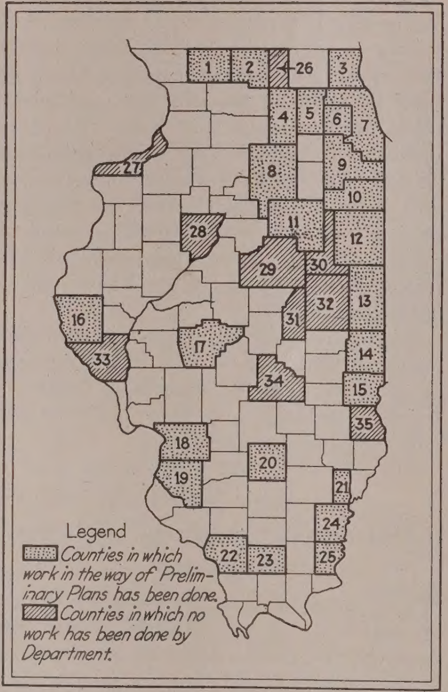
The average American is inclined to be hasty and is often unduly influenced by impressions. If he happens to have driven recently over any considerable mileage of one type of road which was in good condition, the contrast between the type which he found good and all the rest which he found bad is very impressive, and thus we find large numbers of people who are strongly prejudiced in favor of some particular type or against some other type. Nothing can be more illogical from the standpoint of economy. Every type has a value or ability to render service and a corresponding cost. The cost of service, then, is the first cost plus maintenance cost plus the interest on the money divided by the number of users, and, therefore, if the type is properly adapted to the traffic, the cost of service is approximately the same on all types.

The construction of a system of roads at one time presents a very different problem from the construction piecemeal of a few main roads of limited extent and benefit in a restricted district. When a single road is built it must necessarily be of a type which will accommodate the sudden and marked increase of traffic that always follows the opening of a newly improved road, because of the great number of vehicles drawn from shorter and unimproved arteries, between source and destination, to the smoother and more agreeable surface. The building of another road in the vicinity will have an immediate bearing on the amount of traffic carried by the first, and a financial loss results either through building a more costly type than necessarv to sustain the normal traffic, or through involving an excessive maintenance cost by developing an abnormal traffic.

EQUALIZE COST TO ALL USERS

The design of a system of roads enables us to take advantage of the economy of proportioning the type of road to the traffic it will be called upon to bear. To make the point clear it must be kept in mind that the cost of a road comprises three principal elements of expense—the first cost, the maintenance charge and the interest on the money invested. These are all variable quantities, but by proper design the cost to the user may be made approximately constant throughout any system of roads, just as a sewer system composed of various sizes of pipe may be designed to carry the amount of water reaching any part on it, and the cost spread over a benefited territory in proportion to the benefits received.

The following figures have been prepared to illustrate this point and should not be taken to represent average cost or even the cost in any particular case; the purpose being solely to show that by proper design the road types may be so proportioned to the traffic that the cost of service or cost per user may be made approximately constant.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Legend
▦ Counties in which work in the way of Preliminary Plans has been done.
▨ Counties in which no work has been done by Department.

ILLINOIS COUNTIES CONTEMPLATING HIGHWAY BOND ISSUES

For this ilustration we have taken an oiled earth road at $1,000 a mile, a gravel road at $5,000 a mile and a concrete road at $10,000 a mile. We have also assumed money worth 5 per cent, and have taken a period of five years for computation, though any number of years would serve the purpose. The amount paid by the county is in conformity with the Illinois law.

$1,000 EARTH ROAD

	Cost	Paid by county
Interest	$250	$125
Maintenance	500	500
Oil first year	200	100
Oil second year	200	200
Oil third year to fifth year.	300	300
First cost	1,000	500
	$2,450	5/$1,725
Average per year		$345

Assuming an earth road carries an average of 100 vehicles, then the county pays $3.45 per user per year.

$5,000 GRAVEL ROAD

	Cost	Paid by county
Interest	$1,250	$625
Maintenance	500	250
Repairs	500	250
First cost	5,000	2,500
	$7,250	5/$3,625
Average per year		$725

Assuming a gravel road carries twice as many vehicles as the earth road, or 200 vehicles, the county pays $3.62 per user per year.

Assuming a concrete road carries twice as many vehicles as the gravel road, or 400 vehicles, the county pays $3.12 per user per year.

$10,000 CONCRETE ROAD

	Cost	Paid by county
Interest	$2,500	$1,250
Maintenance (paid by state)	500	....
Repairs (paid by state)	125	....
First cost	10,000	5,000
	$13,125	5/$6,250
Average per year		$1,250

It thus appears that the cost per user to the county is about the same on all types. The amount of traffic on each of the various roads of a completed system is very nearly in proportion to tributary population and the value of the surrounding property. This makes it possible to design a balanced system of roads on a percentage basis of assessed valuation.

Our principal object in road construction is to produce and maintain a smooth surface for travel, and it matters little to the user what type of road he travels over so long as it is smooth and serviceable at all times.

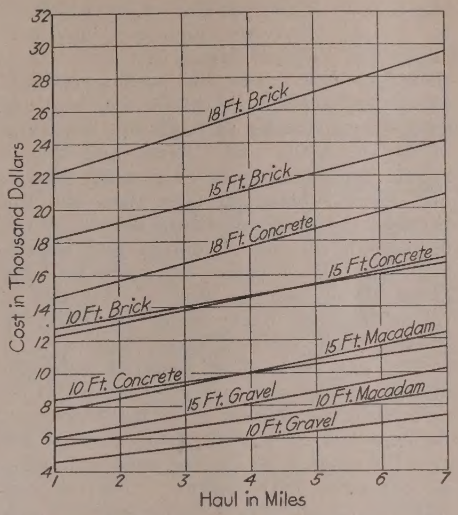
When once we have a smooth surface the cost to the user is the total cost divided by the number of users. Thus, if a road costs $10,000 a mile, and there are 100 users, the cost of serving each user would be $100; while if there were 1000 users the cost would be only $10 for each. It follows from this that if the same type of road is built for 100 users as is necessary for 1000 there is a tremendous waste of money, as it would be entirely practicable to produce and maintain a smooth road which will accommodate a traffic of 100 at a less expense than is necessary for 1000.

If we knew the amount of traffic which each piece of road in a system of roads would be called upon to carry, it would be possible to select a type for each section, the total cost of which, including the maintenance and interest, would make the cost per user approximately the same on each section of the system. This means that in a properly designed system one type is as good as another—that is, a gravel road in the right place is as good as a brick road where brick is required, and, because of the difference in cost, a great deal better than brick would be where only gravel is needed.

HOW TRAFFIC CENSUS IS USED

It will be said that we cannot arrive at an exact measurement of the traffic over any considerable number of roads. This is true, but it is not necessary that we should in order to take advantage of many economies in design. If, for instance, we learn from a single traffic count taken at the same time on each of the roads of a proposed system, that one road is carrying 5, 10, 20, 100 or 1000 times as much as another, this alone will be a valuable guide in selecting the proper type for any particular road of the system, and, taken in conection with such other factors as cost and availability of materials, population of the district and value of surrounding property, we are able to estimate very closely the true economic type.

Again, it may be said that we do not know exactly how much traffic any particular type will bear. This also is true, but it is not necessary that we know this exactly. Even if we did know what a type will do in one locality it does not follow that it will do the same in another, as the cost may be different or the repairs and maintenance less efficiently done. What we do know is approximately how the various types of road surface behave, and, when taken into account, this is sufficient to produce a wonderful economy in the design of a system of roads as compared with the piecemeal one-road-at-a-time method.



COST PER MILE OF DIFFERENT TYPES OF PAVEMENT IN DE KALB COUNTY

Of course, it cannot be denied that the whole problem of road construction and maintenance is very complex in its many details, but there are a few fundamental principles clearly understood and well-defined upon which economy of design rests. If these elementary truths are not generally recognized it is because the road problem is comparatively new and the economic design of road systems almost entirely so.

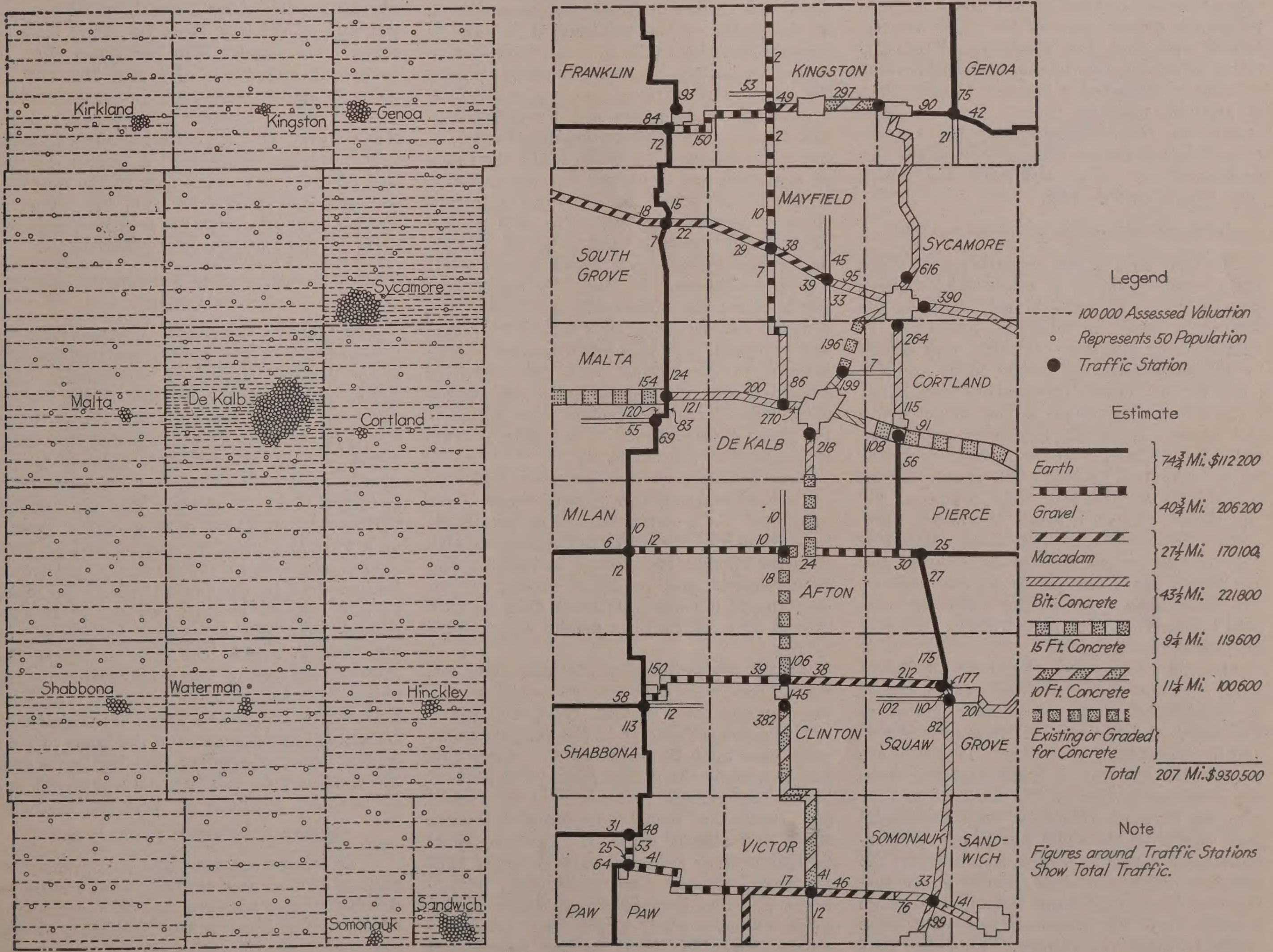
FUNDAMENTAL PRINCIPLES

A few of the most vital of the fundamental principles of economic design are the following:

Money has a certain definite earning value, and, in the outlay of a fixed sum upon any improvement, this earning value or interest over the life of the improvement becomes as much a part of the cost as the first cost itself. For this reason any money unnecessarily spent in construction must be considered as interest bearing for purposes of computing cost.

The use of local materials, while more or less generally considered, is seldom developed to anything like the economic limit. Too frequently materials for use in construction are imported where the expense is by no means justified. If a local material is of such a quality that it will give only half the service of an imported material, but costs less than half as much, it is economy to use the local material. In other words, if less than 50 cents worth of local material will give half as much service as a dollar's worth of a better imported material, then it will be economy to use the local material.

The maintenance of roads in those sec-



CHARTING THE POPULATION AND VALUATION SHOWS IMMEDIATELY THE MAIN ARTERIES—SEVERAL TEST SCHEMES, EACH A COMPLETE SYSTEM, ARE DEVELOPED tions of the country where no considerable mileage has ever been permanently improved is very little understood, and the public generally has a very exaggerated idea of the cost of perfect maintenance of improved roads, due, no doubt, to the enormous sums squandered in the maintenance of unimproved roads. It should be borne in mind that a large mileage of properly constructed roads may, through the use of modern machinery, scientific methods, trained men and constant attention, be maintained at a cost surprisingly low as compared with the average cost in short sections without organization or adequate equipment.

It is astonishing how much money is sometimes wasted in construction, either through improper design or inefficient methods. Into this problem comes the type adapted to the road to be improved, the sequence of construction, the wanton waste of materials either in width or thickness of the metaled way, and many others.

The reconstruction of roads previously improved, either with hard surface or with permanent grading and draining, offers many opportunities for scientific economy, and a recognition of the best possibilities in reconstruction enables us to work with a closer margin of safety in the original design as well as to take advantage of the development of the art.

In designing a system of roads, therefore, to be paid for by taxation, it will generally be found that from considerations of economical service the more expensive types will be required in the districts from which the greater part of the taxes are collected, and that the sparsely settled districts have returned to them in actual value of road constructed a greater amount than is actually paid by them. This is as it should be, for unquestionably the centers of population derive a benefit from the improvement of rural highways for which they should and do pay.

How Selection Is Actually Made

The first step in the preparation of plans for a county system of roads is to make a map of the county and vicinity showing the townships and the adjacent townships of surrounding counties. On this map should be shown in addition to the cities and villages of the county in question such other large cities and villages in the nearby counties as may be readily indicated, and which will have a bearing on the amount of traffic to be expected through the county under consideration. Such a map prepared for De Kalb County, Illinois, is shown herewith. The circles indicate a population of fifty people geographically distributed and are taken from the U. S. census reports. The lines drawn across the township indicate a valuation of $100,000 each, also geographically distributed.

At a glance it is seen that De Kalb Township, with the city of De Kalb, is the center of population and valuation. Sycamore Township and the city of Sycamore is second in importance, and so on. It is also apparent that the line of traffic starting from the southeast corner in the county and running up through Hinckley, west to Waterman, north to De Kalb, northeast to Sycamore, and north to Genoa would carry the greatest north and south traffic, and a line running east and west through De Kalb would carry the greatest east and west traffic through the county. This line east and west through De Kalb happens to be the Lincoln Highway, and on each side of the county there are numerous important cities and villages along this line. It is therefore safe to say that such a road will carry very much more than a road east and west—for instance, through the townships of Milan, Afton and Pierce—and that it should consequently be of a much heavier and more substantial type than the line through the three townships named, which, on account of low valuation and population, and also because there are no large cities either east or west of this tier of townships, can never expect to carry as great a traffic as the Lincoln Highway.

The two factors of assessed valuation and population are very good guides in determining the amount of traffic which may be expected on any road, or at least the relative amount which one road will carry as compared with another. Neither one, however, or any single factor entering into the determination of the amount of traffic can be relied upon to give accurate results even relatively, but, considered in connection with other factors, it is possible to lay out a system of roads and estimate very closely the relative amounts of traffic which may be expected.

Take Traffic Census Simultaneously

The next step is to make a count of traffic on each of the roads of the proposed system. A traffic census taken on one day will ordinarily suffice for this purpose. Even though the total amount of traffic on any one road varies widely with the day of the week, the season of the year, the condition of the roads or the weather, it is safe to assume that the traffic over a whole system is approximately the same relatively under the varying conditions, barring, of course, a road which is in very much better condition than any of the surrounding roads. It therefore follows that when all of the roads of a system are improved the relative distribution of traffic under varying conditions of season, weather, etc., will be approximately constant, and it is the relative importance of the roads which we are seeking to determine. If, then, the traffic census is taken simultaneously throughout the system, and recorded on a map with large, red numbers, and this information is considered in connection with the assessed valuation and the population, it will enable us to determine with comparative accuracy the relative importance or amounts of traffic on each of the roads.

Several plans are then prepared and submitted to the committee of the county board appointed to investigate. This committee then considers the plans in connection with its own knowledge of local conditions and requirements and makes a report recommending that some particular plan be submitted to a vote of the people as provided by law.

All the preliminary studies and plans are made for the purpose of settling the broader questions of cost, type, etc., which are of general interest to the taxpayer who must pass upon the proposition. After this has been done the details, always important but of less general interest, may be worked out from the results of more elaborate study and careful surveys. The numerous tentative plans are necessary in order that we may compare their individual advantages and disadvantages and finally arrive at a balanced plan, which may be designated either too light or too heavy, but which will nevertheless be harmonious throughout. The cost of service will go up somewhat, either through increased maintenance cost, if the design is too light, or through increased interest and first cost if the design is too heavy. It is not at all likely, however, that any serious mistake under ordinary conditions will be made either way, and certainly not so great as by haphazard selection.

There is another great advantage in preparing a number of preliminary plans in that they serve to clear the situation to the average man on whom we must depend for support if we would have success.

Advocates Self-Supporting Rapid Transit Line

Build in Steps at Philadelphia as Needed and Charge a Fare That Will Pay the Cost, Says Director William S. Twining

STATING that new rapid transit facilities in Philadelphia should be built in moderate steps, each to be assimilated by the city and the operating company before the next is undertaken, and that a sufficient fare should be charged from the outset to make each step a paying proposition without increasing the tax rate of a future generation to pay interest on construction cost, the new report of William S. Twining, director of city transit, points out the waste that would result from building the entire proposed system at present inflated prices under the present plan of meeting the cost from a large fifty-year bond issue and charging a 5-cent fare, which would not pay the way of the new lines for some time to come. The report also concludes that in tunneling under the city hall the city is going to an unnecessary expense to locate a station where it would later produce needless congestion. A further study of traffic conditions has suggested a partial relocation of the distributing loop in the business sections, but aside from this the report is concerned chiefly with the proposed methods of financing the proposed construction.

Terms of Operation Should Be Known at Once

The report considers inexpedient the undertaking of the whole construction program during an era of abnormally high prices and before the operator of the system has been determined upon and the terms of operation settled. It is suggested that these terms should be definitely known before more construction than is now authorized is undertaken. It appears that the demand for the construction of the entire system as a unit is a political one, backed by local organizations in all the territory that would be benefited by the present plan. In order to put a check on this demand it is suggested that the necessary legislation be obtained to enable the city to assess the interest charges of the construction on the property in the districts benefited. As this, however, would not be possible without constitutional amendment and the lapse of four or five years, it appears that the issue over the construction plan will be a straight one of business methods vs. political methods.

Construct Trunk Lines First

It is suggested that the comprehensive plan of routes now contemplated should be divided in two sections, the first consisting of the trunk lines in the 25-minute streetcar zone from the city hall. Of these lines, which include the Broad Street subway and delivery loop from Oregon to Erie Avenues, the Frankford elevated line to Bridge Street, the Twenty-ninth Street line and the Woodland Avenue line, only such lines should be built at the present abnormal prices as may be considered necessary and terminal sections. This would include the Frankford elevated line and the Broad Street subway, including the loop, from Spruce Street to Erie Avenue with an extension of the Walnut Street line of the loop to Sixteenth Street. It is proposed to make the Broad Street subway four-track from Ridge Avenue at the north end of the delivery loop to Erie Avenue, and to make all the other lines two-track. To bring the city hall station several feet nearer the street, to discharge its passengers outside of the city hall square where they will not have to cross crowded streets to get anywhere, to space the station better with reference to the Chestnut Street station below it and the Vine Street station above it, and to reduce the cost of construction near the city hall, a relocation of this section is proposed which only goes under one corner of the city hall building. Instead of making the north side of the delivery loop a line under Arch Street, where it is estimated that less than 20 per cent of the inbound passengers would alight, it is proposed to close this side of the loop by constructing a diagonal line under Ridge Avenue from Eighth Street back to Broad Street, thus serving a larger area.

Following this construction and the completion of the remainder of the trunk and terminal sections, it is suggested that the remainder of the proposed system be treated at extensions to be built and financed as conditions warrant.

FINANCIAL BENEFITS TO CITY

If the proposed modification were carried into effect, it is estimated that by charging a slightly increased fare, at no time more than 5.7 cents, and reducing it as conditions warrant, the city's annual deficit would be reduced to $40,000—practically wiped out—by 1940, as compared to a total deficit of $30,000,000 to be expected in 1940 under the plan now contemplated. Only once during this time under the proposed plan would a deficit greatly in excess of $600,000 occur, while under the present plan from the time of operation till 1936 the annual deficits would exceed $1,000,000 and would several times exceed $2,000,000. According to the proposed plan, with a total capital investment on the part of the city and the operating company by 1921 of $39,506,000, 8.69 sq. mi. of territory could be brought within a 25-minute ride of the city hall. According to the present plan an expenditure of $63,548,000 would be made to bring into this zone a total area of 14.72 sq. mi., at a cost per square mile of 46 per cent in excess of that under the proposed plan. The financial comparison is more favorable to the proposed plan than is shown, as the net income from the Camden tunnel, which both plans agree should be built by private capital, is credited to the annual deficit under the present plan, but not to that under the new proposal.

Boston Elevated Railroad to Build Creosoting Plant

A creosoting plant is to be built by the Boston Elevated Railroad for treating ties and other timber material used in its structural work.

Small Irrigation Canals Lined with Concrete to Prevent Seepage Water Loss

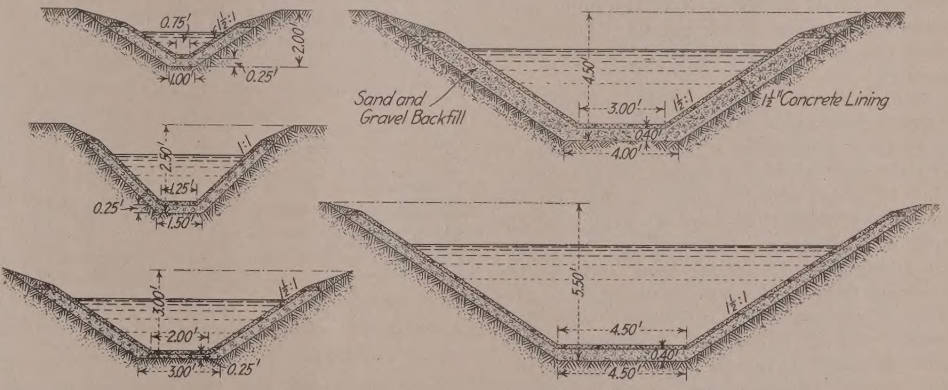
Part II of Article Giving Details of Construction and Cost of Work on Okanogan Project in Washington

By C. E. EDWARDS
Civil Engineer, Okanogan, Wash.

In the first part of this article in last week's issue, page 508, Mr. Edwards discussed the design of the canals, grade and alignment, working crew, hauling and placing of backfill and the shaping of the ditches with templates. This week's installment deals with the concrete mixing and placing, wages of working force and detailed costs.—EDITOR.

THE supply of aggregate for concrete was usually obtained close to the work; the haul seldom exceeded 1 mile and the average haul was ¾ mile. The aggregate was hauled in advance and placed at regular intervals along the canal, usually about 50 cu. yd. in each place.

Pit run was generally used; everything larger than would pass through a 1-in. mesh screen was taken out. The material, therefore, contained an extra amount of sand, but this was desirable in order to make the concrete easier to plaster and get an impervious surface. Frequent tests were made for the amount of voids in the aggregate, and the amount of cement was varied accordingly. A minimum of 5 sacks per cubic yard was used and a maximum of 6 sacks per cubic yard was sometimes required and used. The average for all the work was 5.2 sacks for each cubic yard of concrete placed.



CROSS-SECTIONS OF LINED CANALS FOR WHICH COSTS ARE GIVEN

MIXING CONCRETE

Most of the mixing has been done with a ¼-yd. Northwestern mixer, mounted on trucks and operated with a 5-hp. gasoline engine. The mixer is equipped with a self-loading bucket, the discharge end of the drum being operated with a door, which made it convenient for loading wheelbarrows. A tilting mixer could not be used to advantage on this kind of work.

The mixer came equipped with a 1-in. rotary pump for supplying water, but this pump did not prove satisfactory on account of the long supply pipe and high lifts that were occasionally necessary. After the pump had worked about two months it would no longer supply a sufficient quantity of water when operated from the mixer. It was then taken off the mixer and mounted on a small platform and connected to a 1½-hp. Fuller & Johnson gasoline engine. This outfit was placed next to the water supply and the water forced through the supply pipe instead of drawing it through, as was necessary when it was mounted on the mixer.

Three rotary pumps were worn out in six months' work. A 5-in. piston pump has been used since that time, and has given satisfaction, supplying more than twice the amount of water that the rotary pumps did with the same amount of power. The pumping outfit is practically automatic, requiring very little attention except to keep up the supply of gasoline and oil. It will run eight hours on 3 quarts of gasoline and ½ pint of oil, and supply enough water under a 10-ft. lift to mix 75 cu. yd. of concrete. The supply pipe from the pump to the mixer was from 300 to 450 ft. in length, depending on the length of set up and location of the mixer. The mixer was always located as near the middle of the set up as local conditions would permit.

The platform for the mixer was set on solid ground whenever possible, but in a good many cases the banks were so narrow that it was necessary to build the platform out over the lower bank or across the canal. The minimum size of the platform was 16 ft. square and, where possible, this was increased to 16 x 20 ft., and the mixer set crossways on the end nearest the aggregate. The floor of the platform was nailed down in all cases to make it solid so as to facilitate the movement of the wheelbarrows to and from the mixer.

The time of unloading the batch into the wheelbarrows after the mixing is completed is one of the limiting conditions to a maximum output, and special effort was made to eliminate all delay at this point. An incoming and outgoing runway was built in each direction, so as to avoid confusion at the mixer. Two complete sets of platforms and runway boards were used. The set not in use was moved ahead to the next set up and was all in place when the mixer was ready to be moved ahead.

When loading, the bucket was filled one-third full of aggregate and then ½ sack of cement was put in. The bucket then was filled two-thirds full and a full sack of cement added, the balance being filled with aggregate. Two men are required to shovel the aggregate and one man to handle cement. The water is turned on as the bucket starts to discharge, as it was found by experiment that this gave the best results in getting all the batch mixed to the same consistency. Sufficient water was applied to make the concrete wet enough to spread easily.

The man that ran the engine operated the loading bucket and the water supply and signaled the man loading the wheelbarrows when the batch was mixed. Under ordinary conditions a batch was mixed every 2½ min., 1 min. being taken to mix the batch before the discharging was started; 1½ min. for unloading was usually required. A batch made five or six wheelbarrow loads. The average output of the mixer was 6½ cu. yd. per hour.

Wheeling Concrete

The concrete was hauled in wheelbarrows having a maximum capacity of 3 cu. ft., the maximum haul being 450 ft. and the average 200 ft. From seven to nine wheelers were employed, each man hauling from 6 to 7 cu. yd. in 8 hr. The runways were made of 1½ x 12-in. and 1½ x 10-in. tamarack planks, 16 ft. long, usually laid on the lower bank of the canal. The 10-in. planks are plenty wide enough for experienced wheelers, and do not split at the ends quite as readily as the wider planks. Then, too, they are cheaper and easier to handle when moving.

When the banks were low and the concrete lining came close to the top the running boards were set 3 ft. from the edge of the lining whenever possible, on account of the passing wheelbarrows bothering the plasterers while they were working near the top of the lining. When it could be used to advantage the canal bank outside the running boards was leveled up so as to provide a return track for empty wheelbarrows. When it was not economical to do this frequent turnouts were made, so that the empty wheelbarrows could avoid the loaded ones without stopping to wait.

Placing Concrete

The best organization for placing concrete in ditches having a bottom with from 2 to 5 ft., where the output averaged 50 cu. yd per day, was found to be four three-man crews, each crew being composed of two plasterers and one shoveler. These crews were distributed along the canal as follows: For a setup 700 ft. long crew 1 started at the upper end of the section, crew 2 about 160 ft. below crew 1, and crew 3 about 190 ft. below crew 2, and crew 4, 190 ft. below crew 3. Crew 4 worked 160 ft. The two middle crews were each given 39 ft. extra, as it was found that the concrete spread so much easier on the shorter hauls than it did for the longer hauls.

All four crews worked down the canal in this way; the average length of haul was kept the same until the setup was completed. The crews were alternated from the long to the short haul on each setup so as to make up for any possible inequalities in the amount of work required from each crew.

The platforms for dumping the concrete on at the point where it was being applied were made 6 ft. square and set on trestles 2 ft. high for ditches having a bottom width of 2 ft. or more. The platforms were laid across the ditch without trestles when the bottom width was less than 2 ft. These platforms were made of 1½-in. plank nailed on four 2 x 4-in. stringers, set on edge. On the back end of the table near the corner next to the runway a short 1-in. strip was nailed for holding in place the running board that connects the table with the runway.

This running board was set at an angle of 45 deg. to the center line of the canal, and always pointed up the canal toward the shoveler so that in dumping the wheelbarrows—always done over the front end—the shoveler could clean out any concrete that might stick to the bottom of the wheelbarrows as they were being turned back by the wheeler. It was found that considerable time of both shoveler and wheeler was saved if the wheelbarrows were tipped ahead just before they reached the bottom of the running board and allowed to land full force upside down on the platform. This requires some skill on the part of the wheeler and is rather hard on the trays of the wheelbarrows, but the extra saving in time for the whole crew more than pays for the damage to equipment, as the concrete usually comes out clean and the shoveler is not delayed at all by having to stop to clean out the barrows.

Cost of Lining Canals with Concrete

Item	Section A		Section B		Section C		Section D		Section E	
Width of bottom, feet	0.50		1.25		2.00		3.00		4.50	
Total depth, feet	1.10		2.00		2.25		3.20		4.60	
Perimeter in feet (including berm)	5.45		7.93		11.10		15.52		22.06	
Side slopes	1:1.5		1:1		1:1.5		1:1.5		1:1.5	
Cu. yd. concrete per 100 ft. of canal	2.52		3.65		5.15		7.15		10.20	
Cu. yd. backfill per 100 ft. of canal	5.00		7.5		12.00		38.0		28.0	
Lin. ft. per cu. yd. of concrete	39.50		27.40		19.40		14.00		9.82	
Location	sidehill		sidehill		sidehill		level		level	
Item.	Per cu. yd.	Per lin. ft.	Per cu. yd.	Per lin. ft.	Per cu. yd.	Per lin. ft.	Per cu. yd.	Per lin. ft.	Per cu. yd.	Per lin. ft.
Foundation	$1.518	$0.038	$2.540	$0.093	$2.750	$0.142	$3.005	$0.215	$1.400	$0.143
Plant	1.367	0.035	0.895	0.032	0.840	0.043	0.693	0.050	0.731	0.075
Gravel and Sand	1.023	0.026	0.960	0.035	1.080	0.055	1.021	0.073	0.630	0.064
Cement	2.990	0.076	2.930	0.104	2.520	0.130	3.117	0.223	3.254	0.332
Water	0.013	0.001	0.022	0.001	0.026	0.001	0.011	0.001	0.024	0.002
Mixing	0.411	0.010	0.404	0.015	0.380	0.020	0.350	0.025	0.343	0.035
Wheeling	0.705	0.017	0.582	0.021	0.508	0.026	0.450	0.032	0.431	0.044
Placing	1.000	0.025	0.923	0.035	0.900	0.046	0.790	0.056	0.900	0.091
Sprinkling	0.108	0.003	0.100	0.004	0.100	0.005	0.042	0.003	0.036	0.004
Supplies	0.160	0.004	0.120	0.009	0.157	0.008	0.063	0.005	0.046	0.005
Superintendence	0.140	0.003	0.120	0.005	0.120	0.006	0.120	0.008	0.120	0.013
Time and Cost Keeping	0.120	0.003	0.100	0.004	0.154	0.008	0.120	0.008	0.100	0.010
Engineering	0.260	0.007	0.204	0.007	0.160	0.008	0.095	0.007	0.050	0.005
Total for Concrete	8.297	0.210	7.160	0.262	6.945	0.356	6.872	0.491	6.665	0.680
Total for Concrete and Foundation	9.815	0.248	9.700	0.355	9.695	0.498	9.877	0.706	8.065	0.823

The shoveler used a No. 2 scoop shovel with which he placed the concrete on the slopes for the plasterers, who were equipped with a wooden float, a plasterer's trowel. a straight edge for the side and another for the top of the berm. In ditches more than 2 ft. deep ladders were used on the side slopes and the straight edges for the sides were nailed to these ladders. The plasterer spread the concrete to an even surface with his float on a strip about 18 in. wide, down the slope, at one time, the thickness being gaged by the strip just completed and the straight edge on the ladder. After this strip has been floated smooth it is finished with the plasterer's trowel. After the plasterer moves his straight edge or ladder ahead he always strokes the edge of the concrete just completed to give it a bevel. If this is not done a hair crack will sometimes appear at this joint after the concrete has started to set.

Plaster Lath Best Joint

Every 10 ft. a contraction and expansion joint was made. Several kinds of joints and jointers were tried. The easiest and most satisfactory joint was made with a common plaster lath, which was sharpened on one edge. To make the joint, this lath was pressed into the concrete to a depth of 1 in. and then immediately removed. The crease made was then stroked gently with a trowel to smooth down any rough edges made by removing the lath. The plasterers worked opposite each other and took turns in placing the bottom.

The corners where the side slopes join the bottom and the berm were rounded, as this was easier than making square corners and gives a very good appearance. The outside edge of the berm is sloped off as soon as the straight-edge is removed. This widens the berm a little and gives an increased security from damage by surface water getting under the lining after the backfilling on the berm has been done.

An average day's work for one crew of two plasterers and a shoveler was 12 cu. yd., but as much as 16 cu. yd. have been placed by one crew on several occasions. With lining only 1½ in. thick 12 cu. yd. of concrete makes about 2500 sq. ft., and 16 cu. yd. makes 3250 sq. ft. of lining.

A track man was employed who kept the runways in order, helped the shoveler of the placing crews to move the shoveling tables when necessary and did such other work as the foreman directed. One man was employed in sprinkling the backfill ahead of the plasterers as the surface dried somewhat from the time the flooding was done until the concrete could be laid.

It was necessary to wet the concrete after it had been placed to keep it from getting too dry while curing, and as it damages the concrete to back the water up in the canal high enough for this purpose, another man was employed to keep the concrete wet for six or seven days after it has been placed. This work was started 24 hours after the concrete had been placed. The water for this work was backed up in the canal about 6 in. deep and the man walked along the banks and pulled the water up the slopes with an implement made for this purpose, which consisted of a light narrow board 2 ft. long, fastened at right angles to the end of a long handle. This was much quicker and more effective than sprinkling and one man could wet 1 mile of small canal with a 16-ft. perimeter four times a day.

Water Supply

The water supply was kept up within 400 ft. of the mixer by running it into the canal and holding it with low sack dams. As each move was made another dam was built and the water allowed to follow down. A sack dam was found the most convenient and dependable on account of the ease and safety of handling the water over green concrete. As the dam could not be built until the upper section was completed, precautions were taken to have everything in readiness beforehand. For the average move, which requires 30 min., the water supply is the last thing ready, and any delay on this account would increase the cost of moving considerably with the whole crew waiting for water. One of the laying crews built the sack dam and let the water down. This crew was designated each time by the foreman.

MOVING AND SETTING UP

When the rotary pump, which was mounted on the mixer frame, was used, it was necessary to lay the pipe in the bottom of the ditch in order to get a gravity flow up to within 20 ft. of the mixer; otherwise the pump would not supply a sufficient quantity of water on account of the difficulty in making tight joints on a pipe that was being moved daily. Some time was always lost in getting the pump primed after each move.

With a separate pump and engine the pipe was laid on the bank, out of the way of the plasterers, and could be moved in about half the time without damaging any lining in taking it apart at the unions and getting it out of the canal.

It required four horses to move the mixer on all moves on account of its weight of nearly 3½ tons and the low trucks, which made it very hard to move over rough roads. The average time for moving and setting up ready to start again was 30 min. and the minimum 20 min. When finishing mixing for the previous set-up all the wheelbarrows were filled and run to the placing crew on the lower end of the set-up, so that in most cases this crew was kept busy plastering while the move was being made.

SALARIES AND WAGES PAID

Concrete foreman, per month	$100.00
Team and backfill foreman, per month	90.00
Surveyman, per month	85.00
Timekeper, per month	85.00
Rodman, per 8-hr. day	2.50
Operator for Mixer, per 8-hr. day	3.75
Plasterers, per 8-hr. day	2.60
Shovelers (concrete), per 8-hr. day	2.60
Shovelers (hopper), per 8-hr. day	2.40
Laborers, per 8-hr. day	2.20

COST DATA

Careful cost records have been kept on all the canals lined, which amounts to 134,000 lin. ft. of canal and has required 7500 cu. yd. of concrete. There is submitted herewith a condensed summary of these records for the different sized canals and laterals. These costs cover all expenses except overhead charges from the connected offices of the Reclamation Service.

Part of the lining has been in use for four seasons and has given good service and shows no signs of wear. Up to date it has required no expense for maintenance, except at a few places on some of the first work. Where drainage inlets were not constructed at the time the lining was placed.

The friction factor for this kind of lining as determined from experiments varies from $n = 0.010$ for canals having a straight alignment and perfectly free from shifting sand and pebbles on the bottom, to $n = 0.015$ for canals having numerous curves and a limited amount of moving sand along the bottom.

No trouble has been experienced on account of expansion or contraction injuring the lining, even when the water is rotated and the canal is dry half the time during the summer. In general, the lining has proved very satisfactory and the indications are that it will give good service.

5-Ton Garbage Reduction Plant Yields Profit to City

Test of New Works at Pontiac, Mich., Indicates Absence of Odors—Gross Revenue $14.70 Daily

By GEORGE R. BASCOM
Municipal and Sanitary Engineer, University Extension Division, Madison, Wis.

A SHORT test of the newly constructed garbage reduction plant at Pontiac, Mich., was recently made by the writer and Leon Smith, assistant city engineer of Madison, Wis. The findings are briefly as follows: The plant operates in a perfectly sanitary manner, without any offensive odors. Both of us are agreed that any city could place such a plant in a central location and operate it so that no objectionable odors could be noted. The only disagreeable feature of the works is the coming and going of the garbage wagons, but if up-to-date equipment for collecting the garbage were used it would be possible to operate in almost any section of the city in a manner which would not be objectionable. The odors of the average automobile garage are much more dangerous and much more unpleasant than the odors of the Pontiac plant. In fact, we could smell nothing when standing outside the doors of the building, while inside there was noticeable an odor which was about the same as the smell of licorice or chicory. It was in no sense strong or offensive.

BY-PRODUCTS RECOVERED

The elimination of the odors is accomplished by digesting the garbage in steel tanks under 70 lbs. of steam pressure, and, throughout the process, drawing off the usual offensive odors by means of a vacuum pump. These gases are condensed and discharged into the sewer. To make sure that the condensed gases are properly disposed of, a solution of nitrocene is injected into them prior to discharging into the sewer.

Our test of the Pontiac plant showed that by this method there is made available at least 250 lb. of tankage and 43.75 lb. of grease per ton of raw garbage treated. The value of the tankage depends on the fertilizing properties contained in it and varies with the quality of the raw garbage and with the process of reduction. I am led to believe from the method used in digesting or cooking the garbage and from the analysis of the Pontiac tankage, that it is worth more than the average garbage tankage. An estimate of the value of the Pontiac tankage was made by W. H. Strowd, of the University of Wisconsin, who specializes in feeds and fertilizers. His report follows:

"I give below the value of a ton of garbage tankage on the basis of the analysis which you handed me and which is returned herewith. The following prices per pound of plant food materials are used. These are the figures adopted by the Association of Eastern Experiment Stations for 1915, and are based on the average wholesale prices of the materials for a period of six months beginning Sept. 1, 1914:

"Nitrogen, 20 cents; phosphoric acid, 4 cents, and potash, 8.5 cents. From these figures the value of the plant food in a ton is as follows: Nitrogen, $12.20; phosphoric acid, $2.76; potash, $1.53. Total, $16.49."

The following analysis of the Pontiac tankage, as made by Andrew J. Patten, of the Michigan Agricultural College, is the one referred to in Mr. Strowd's report: Nitrogen, 3.03 per cent; phosphoric acid, 3.45 per cent; potash, 0.9 per cent. Mr. Patten states in his report:

"This sample agrees very well in composition with other samples of garbage tankage analyzed in this laboratory."

PROFIT IN TANKAGE

The statement by Mr. Strowd shows the value of the tankage to be $16.49, which means (using the data obtained at Pontiac), that there is available from tankage alone a value of $2.06 per ton of raw garbage, if it is uniformly as rich as the sample. This is about three times as valuable as the average tankage which is obtained from garbage-reduction plants using solvents to obtain the grease. At $6 per ton, which is a fair average of the selling value of garbage tankage, and taken on a basis of 250 lb. per ton of raw garbage, there is available 75 cents per ton of raw garbage from the tankage alone.

The value of grease can conservatively be taken at 5 cents per pound—it has been bringing 6½ cents in Chicago during the last few months. On this basis, the grease obtained is worth $2.19 per ton of raw garbage. The combined value of the by-products is, therefore, equal to $2.94 per ton of raw garbage.

Offsetting this revenue, we found the cost as follows:

Two men—one foreman and one assistant—operated the plant, and when the additional tank is installed (which should be done before summer time) they can take care of 5 tons of raw garbage per day. The coal used during our test amounted to much more than would be needed if some changes were made in the equipment, as, for example, the installation of a press to assist in drying the tankage and by the substitution of an electric drive for the agitator in place of the steam engine now in use. On a basis of $4 per day for the man in charge and $2 per day for the assistant, and computing the coal at $5 per day, we have the operating cost at $11 per day.

If we neglect the smaller items such as lubricating oils, waste, light, telephone and such larger items as interest on the investment, depreciation and maintenance, the statement of the Pontiac plant is as follows:

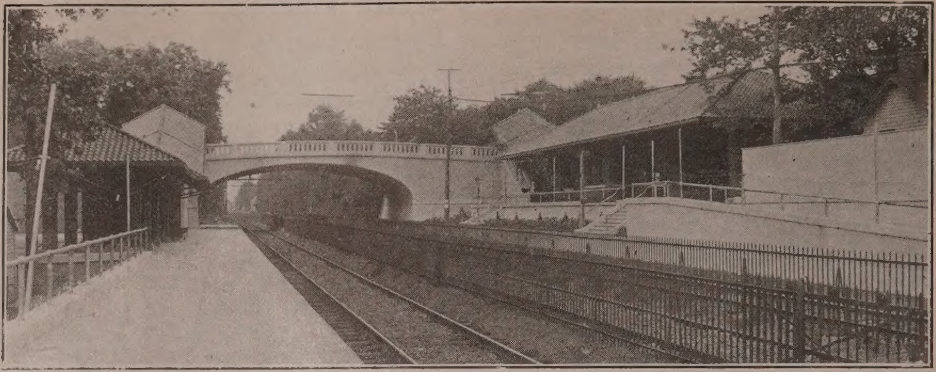
Gross revenues—5 tons of raw garbage per day at $2.94 per ton, $14.70; cost of reduction, $11; net revenue per day, when operating on a basis of 5 tons, $3.70.

This study has justified an opinion which I have held for some time, that garbage reduction is feasible in small cities both from a sanitary and from an economic standpoint. The fact that most of our *garbage burners* are municipally owned and operated at a loss to the community while most of our *reduction plants* are privately owned and operated at a *profit*, should stir city officials to investigate and engineers to demonstrate further the limits of the reduction process. If garbage in quantities as small as 5 tons per day can be made to cover the operating expenses of the process of reduction, there will be cause for hesitating in burying, burning or even feeding garbage in small cities.

The equipment used in the Pontiac plant was designed and erected by Henry Wagner, consulting and sanitary engineer of Cincinnati.

A Small Railroad Station That Pleases the Eye

In Mountain Station, South Orange, the Delaware, Lackawanna & Western Railroad Has Produced Far More Than a Mere Shelter



STATION, ARCH AND SHELTER HOUSE BLEND INTO ONE HARMONIOUS WHOLE

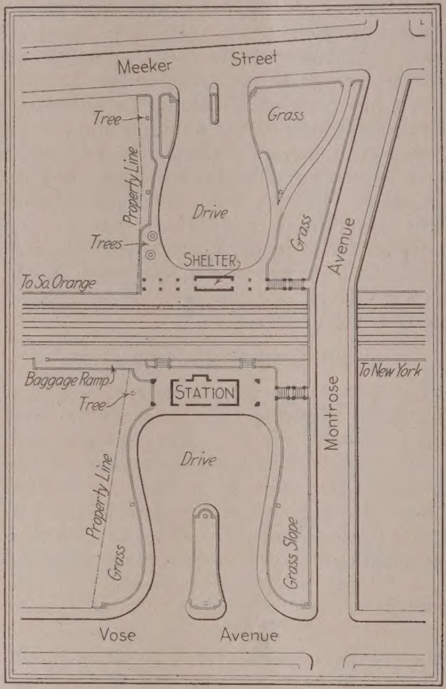
WHAT can be done with sufficient money to make a small railroad station a thing of beauty instead of a mere shelter from the elements is strikingly shown at Mountain Station, in the town of South Orange, N. J., on the Delaware, Lackawanna & Western Railroad. The new station is incidental to the elimination of a grade crossing nearby. When it was decided to carry the avenue over the tracks, on an ornamental arch, it became necessary, to satisfy the Lackawanna esthetic standard, to replace the old frame structure. Photographs are shown of the new station, which consists of a main building on the south side and a smaller shelter house on the north side. Not the least attractive features are the ample approaches. In fact in the entire improvement—buildings, arch, approaches and minor details—the esthetic side has been kept uppermost.

PARK SPACES PROVIDED

The drawing shows the general layout at the station. The railroad company owned some of the property between its tracks and Vose Avenue, and all of the remaining land between Vose Avenue and Meeker Street was acquired for the approaches. The illustrations show the arrangement of driveways, walks and park spaces, the graceful curves introduced, the location and character of lighting standards and the other features that give the grounds individualism.

The buildings and portico columns are of dark-red Bloomsburg wire-cut brick. The roofs are of green tile. The Montrose Avenue arch is of concrete, given a rough finish with smooth trim, and is surmounted by ornamental concrete balusters. It may be mentioned in passing that in the various stairways safety treads, which have been found to rust and discolor the concrete, have been eliminated. Instead of them carborundum has been mixed into the surface concrete itself, giving a rough surface which has proved entirely satisfactory.

The improvement is in a residential section of the better class, and efforts were made to minimize the damage to abutting property. To avoid encroaching on the property east of Montrose Avenue and south of the tracks the avenue, which formerly ran straight from the Vose Avenue to the Meeker Street intersection, was swung westward as shown.



ARRANGEMENT OF STATION, SHELTER HOUSE AND PARKED APPROACHES

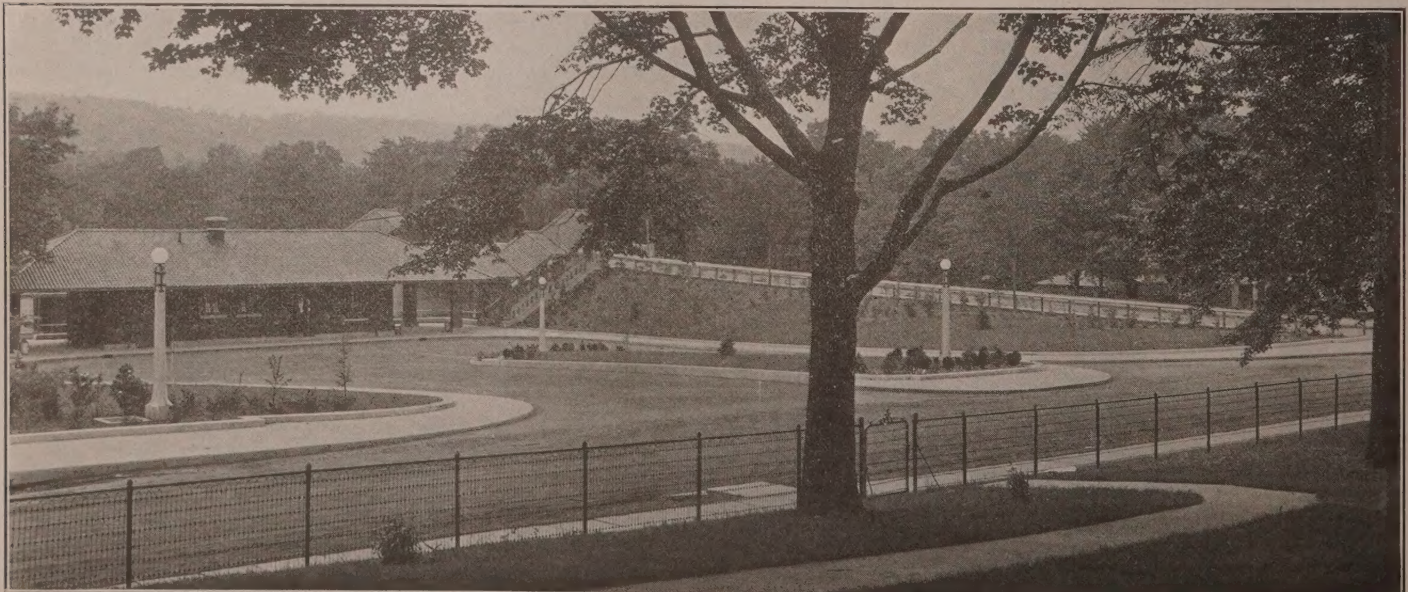
GRADING RAISES STREETS

The Meeker Street intersection had to be raised some 5 ft. At the northeast corner was an estate with a level expanse of lawn and shrubbery. Instead of walling this off with concrete or earth fill the company graded the whole corner up, so that now one or two walled-in trees furnish the only evidence that the streets were raised.

There were a number of large trees along the east side of Montrose Avenue and elsewhere where grading was required. These were not destroyed, but wells of porous concrete were built around them, preserving the old ground surface at the bases of the trees. One of these wells is about 10 ft. deep.

PERSONNEL

The improvement, like the larger section of the South Orange work described in the Engineering Record in the issue of March 18, page 378, was carried out under the general direction of G. J. Ray, chief engineer of the Delaware, Lackawanna & Western Railroad, and G. T. Hand, division engineer. F. J. Nies, architect, designed the station and landscape features, A. B. Cohen, concrete engineer, designed the arch, and W. H. Speirs, assistant engineer, directed the work in the field. Hyde, McFarlin & Burke of New York City, had the general contract for grading and building the arch, while F. D. Hyde of that company built the station under a separate contract.

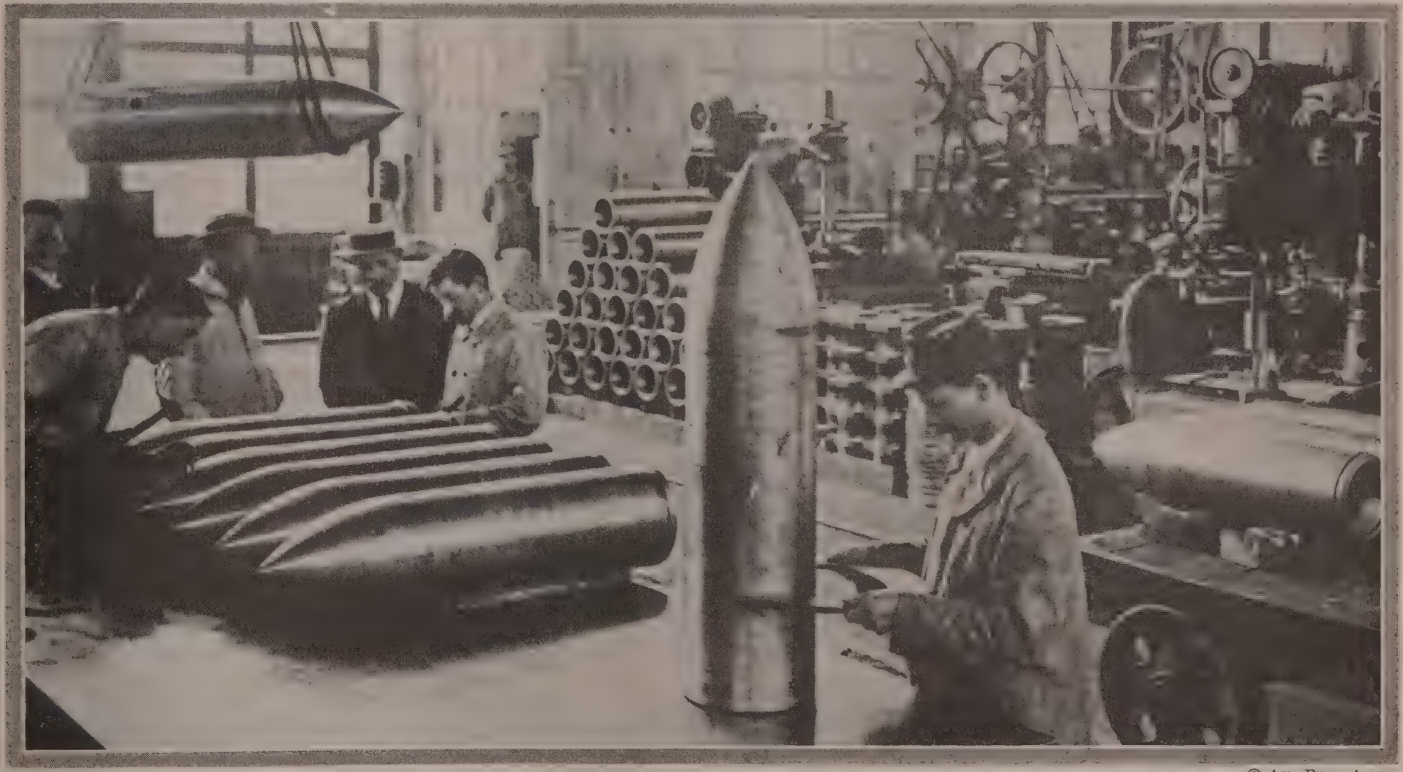


NOT THE LEAST ATTRACTIVE FEATURES OF THE STATION ARE THE BROAD APPROACHES—THIS IS THE SOUTH APPROACH

Plan Outlined for Mobilizing Nation's Resources as Preparedness Measure

Eighth Article in Series on National Defense for Engineer and Contractor Discusses Campaign of Thorough Organization

By MAJOR P. S. BOND
Corps of Engineers, U. S. Army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AT MUNITION PLANTS MANUFACTURERS AND ENGINEERS MAY RENDER VALUABLE SERVICE AS CONSULTING EXPERTS

THE modern theory of war, as we have seen, contemplates in its highest development not only the universal training of the personnel, but the complete mobilization of the material resources of the nation. An army numbering millions requires in its operations vast quantities of supplies of all kinds. Unless these supplies are forthcoming as needed, the nation's defenders, however intelligently organized and splendidly trained, will be unable to oppose successfully the fully equipped troops they will be called upon to meet in the event of war with a foreign power. Such has been the situation of more than one of the nations in the present war.

The supplies necessary are not limited to weapons, ammunition, foodstuffs and clothing, but include the great bulk of the products of our farms, mines, forests and factories. There is also demanded the service of our transportation systems by land and water. Our material resources exceed those of any other nation and are ample for the prosecution of a great and protracted conflict. They are at present, however, very poorly organized from the point of view of military necessity. This is plainly indicated by the lack of system, the delays and extravagance which are attending the furnishing of munitions of war to the European nations. Europe has paid for our inefficiency, but the experience acquired by our manufacturers and their agents will be of undoubted benefit to our own defensive policy.

In mobilizing our material resources it is necessary first to ascertain our probable needs in the event of war. We should then investigate and make record of the sources from which these needs may be supplied, and finally execute all possible preliminary measures necessary to stimulate production. The problem is a vast one, second in importance only to the training of personnel. We can here consider but a few of its most salient features under the three general heads, (a) probable needs; (b) investigation of sources of supply; (c) stimulative measures.

The materials required for the conduct of war may be classified under two heads:

(1) Commercial materials, tools or appliances; that is to say, those which are manufactured and used in large quantities in times of peace.

(2) Materials of equipment which are peculiar to warfare and not ordinarily manufactured at all, or to a limited extent only, for commercial purposes, and which cannot, therefore, be readily obtained on short notice.

The line of demarcation between the two classes is not definitely fixed. Examples of the first class would be axes, barbed wire, automobiles, shoes, anesthetics, dynamite; of the second class, military rifles, portable intrenching tools, haversacks, pontoon boats.

In the event of war the regular and volunteer forces would be called at once to the colors and sent to the front as rapidly as they could be equipped and trained (in the case of volunteers). In order that these troops may be promptly equipped for duty it will be necessary to keep on hand in time of peace a reserve of material, especially of the second class. This reserve should obviously be no larger than necessary—it will be great enough in any case. Its storage and care will be expensive, some of it will become obsolete from time to time, and some will deteriorate and become useless in storage. All of it will represent an investment paying no direct return except in case of war. The amount of each item of this reserve will depend, first, on the requirements of war and, second, on the predetermined rate of production and delivery subsequent to the outbreak of war.

The plans of the general staff will contemplate certain contingencies, and the enrollment, training and equipment of successive levies of men to meet these contingencies. Measures for the mobilization of the material resources should be based upon the greatest probable requirements, but should look further to the possible ultimate utilization of all our resources. A consideration of these probable requirements will indicate what will be needed at the outbreak of war and the rate of production that must be maintained thereafter, if military operations are not to be delayed or hampered by lack of equipment and supplies. Supplies for military purposes can be more readily, quickly and cheaply obtained the more nearly they conform to commercial types and standards. Hence, as far as practicable, they should be identical with, or similar to, the products of peace time. Many of them, of course, must be specially adapted to military needs.

Having tabulated these materials the next step is an investigation of the sources of supply, but to avoid delay, the two investigations may be prosecuted simultaneously. All existing supplies which can be commandeered in case of need without undue hardship to the civil population, such as automobiles and animals, should be located and recorded. Every manufactory in the land, both large and small, should then be investigated to ascertain what material it could produce for military purposes under war conditions. The somewhat modified requirements of the civil population during the war must, of course, also be considered and provided for. This material would not, in all cases, be limited to the regular output of the factory. We should consider not only what the factory does ordinarily produce but what it might reasonably be counted upon to produce with due regard to efficiency and economy. It will be necessary, also, to ascertain the time that would be required to equip the plant and train the operatives to produce a different line of products. The average American industrial plant cannot change in a day, a week, or even a month from its regular output to a new line, unless careful and intelligent preparation be made in advance. Without such preparedness it might be a year before the plant would be operating in an efficient and economical manner in the production of munitions, and then perhaps *it might be too late.* This consideration is regarded as of vital importance to the national defense.

One of the most important features, therefore, of the mobilization of resources is a study of the stimulative measures that may be planned in advance to increase the rate of output. There will be many such measures and they must be carefully thought out. The writer undertakes to direct attention to but a few of these. To begin, as has been pointed out, military supplies should, as far as practicable, conform to established standards. The plans and specifications of these materials should be submitted to the scrutiny of manufacturers. They will thus be able to point out many modifications which will cheapen and speed up the output without seriously affecting the military value of the product. So far as possible, the manufacturers should specialize along their regular lines. The revised plans and specifications should be placed with the manufacturers for study as to measures necessary for rapid production.

Samples of Supplies

Experimental samples of each class of supplies should be produced. This would indicate the methods to be followed in manufacture and the tools and machines that would be required in addition to the regular equipment of the factory. These models and samples, with detailed instructions as to methods of fabrication, should then be placed with important factories or groups of factories. All special tools, machines, gages and patterns that would be needed should be devised. An ample reserve of these accessories should be kept on hand by the government and also placed in the factories themselves, and necessary arrangements made to augment the supply, to the end that at the outbreak of war all factories from which material would be demanded might be properly and quickly equipped to produce this material.

The assistance of the manufacturers themselves will be most helpful. Organizations of manufacturers to assist in the investigation and lining out of plans have been suggested. A thoughtful and interesting study along these lines was presented in a pamphlet recently published by Martin J. Gillen, president of the Mitchell Wagon Company. (See Engineering Record, Nov. 13, 1915, page 589.)

It should be remembered that many of our most important manufactories lie close to the Atlantic seaboard and might be subject to capture in case of invasion. Due allowance should be made for this fact, unfortunate from a military point of view, and corresponding reliance placed upon manufactories farther in the interior of the country which might better hope to enjoy immunity from hostile interference.

Having determined the probable rate of output, a reasonable allowance should be made for a possible increase in demand and for the possible effect of the emergencies of war time on the predetermined rate of output of industrial plants.

Industrial Personnel

The mobilization of our industrial personnel would be a necessary and important feature of this general scheme. During the war the demands of the civil population would be greatly modified and production along certain lines would be much diminished. Certain factories, very many in the aggregate, could be devoted exclusively to the production of munitions of war, and should make preparation in advance, so far as practicable, to take up this work. A readjustment of the industrial personnel would be required to meet war conditions. Many workmen would be thrown out of employment by diminished demand for certain commodities and would be available for transfer elsewhere. Many also would be drawn for service in the volunteer army. There are certain industrial operations in which women are nearly, if not quite, as efficient as men. The field of their usefulness should be investigated with a view to releasing many men from industry to serve with the army. In this manner the women could perform a duty quite as necessary and important as actual service in the field.

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IN THE READJUSTMENT OF INDUSTRIAL PERSONNEL TO MEET WAR CONDITIONS WOMEN ARE PERFORMING DUTIES QUITE AS IMPORTANT AS ACTUAL SERVICE IN THE FIELD

The question of resources is not limited to the supply of munitions of war. The government must look also to the needs of the civil population during war time. For a nation which has not been self-sustaining during peace—and none of the civilized nations is entirely so—and finds its outside sources of supply cut off by war, the problem may be a serious one. The United States can be entirely self-supporting. We can produce within our own borders all of the necessaries of life, and this is an important element in our potential strength. Nevertheless the transition from the conditions of peace to those of war will be a tremendous wrench and the suffering among certain elements of our population, even in localities not directly touched by war, will be great.

The Labor Problem

Many of the industries which supply the things that make life worth living without being absolutely necessary to its mere maintenance, or those producing for export or relying on imports, would be paralyzed by the cessation of demand for their products or the impossibility of marketing their products or obtaining their materials. Their employees would be thrown out of work and would have to be otherwise provided for. Thus the demand for amusements, such as the theater and music, would be greatly diminished, as also the demand for luxuries in food and dress. Financial operations, trading in stocks and bonds and real estate, building operations, the promotion of new industries would all be greatly curtailed. Imports and exports might be absolutely shut off—our foreign purchasing and selling markets closed to us at the very time when the home markets were dull. While many of the activities would eventually revive, the hardships for a time would be very great. Governmental aid and governmental foresight will be necessary to maintain confidence, prevent the sudden changes in conditions, allay panics, and afford succor, all with a view to ameliorating, as much as possible, the hardships which war inevitably entails. As the government depends on the people, so also would the people depend on the government.

Engineers Aid Investigation

To conduct the investigations and institute the measures herein outlined, the assistance of the engineering profession will be absolutely necessary. Steps have already been taken by the President of the United States to enlist the aid of the great engineering societies in carrying out these investigations. As the inquiry proceeds the stimulative measures which may be advantageously employed should become apparent.

Many manufacturers and engineers with manufacturing experience may render valuable service as consulting experts to the plants engaged in the production of war munitions, and the engineering profession should make known to the government the identity of the men who are qualified to render this important service. In the event of war there would be organized in the War Department a bureau to supervise and stimulate the production and arrange for the transportation and delivery of supplies. Many engineers would be employed in such a bureau.

Manufacturers' associations and labor unions must play their part as a patriotic duty. It is very desirable that we be spared the humiliating and distressing spectacle of frequent strikes over questions of wages and hours of labor at a time when the fate of the nation is in the balance.

In the event of war the demands on our transportation systems will be very heavy and it is necessary that we take careful account of our stock. Many railroads and steamship lines would be taken in complete charge by the federal authorities and all would be subject to a degree of federal military control. This control must be sufficient to meet military needs, but can best be exercised through the medium of our big, experienced railroad men. If any attempt is made to replace the expert personnel of the railroads with army officers having little or no experience in railroad administration and operation, a paralysis of our transportation systems would be the logical result.

This mobilization of our resources in material and transportation must probably be based on the voluntary service which is contemplated by our military policy. Nevertheless, as the government has the power to institute compulsory service in case of need, so also has it the power to commandeer the output of our factories, and even to regulate the sale of the necessaries of life to the civil population.

WAR PRICES AND THEIR EFFECT

One question not to be overlooked is that of the prices to be paid for war material. The prices charged the European nations by American manufacturers have, in general, been excessively high, due in large measure to our lack of knowledge of requirements and our inefficiency in a new field of industry. It is believed that our manufacturers generally would have no wish to derive excessive and unreasonable profits from the agony of the nation. And, on the other hand, they should not be required to bear more than their share of the burden by being paid less than the cost of production. It is in the interest of both parties that fair and reasonable prices should be fixed upon in conference and revised from time to time to meet changed conditions. The prices should not be perfectly rigid but capable of adjustment, perhaps on a "cost plus fair profit" basis, or on some other basis which would avoid the necessity for audit of the manufacturers' accounts.

The mobilization plans and data should be kept up to date. The opening of new factories, the enlargement or discontinuance of any already listed should be noted, and allowance made for the effect of changes in industrial conditions, etc. Plans and specifications should be modified or improved where necessary to meet changed conditions or keep pace with industrial progress and invention. Schedules of prices as agreed upon or fixed by the government after investigation should be prepared, and the quota of each factory determined and assigned.

With this information as to our resources in hand, and with all practicable stimulative measures in effect, the government will be able to avoid much of the delay and confusion which have in the past so frequently marred the success of military operations. It will be possible to determine intelligently the nature and amount of the reserve supplies and equipment which should be kept on hand, and the number, capacity and location of the government munition plants which should be maintained in time of peace. In common with the training of our personnel this mobilization of our resources in advance of the outbreak of war will cost money—not a small sum. But in the event of war the returns on the investment would be large, and, as with most things that are worth having, this security is worth paying for. We must divorce ourselves completely from the false hope that we can obtain something for nothing—a hope, be it said, long dear to the hearts of the American people, and which has too frequently in the past been characteristic of our military policy.

In conducting the investigations as to resources and in supervising and stimulating the output, the engineering profession can render a most valuable patriotic service as intermediaries between the War and Navy Departments and the producers. The country will be greatly dependent upon the profession in this matter, since there is no other class of men, civil or military, so well qualified to perform this important duty.

HISTORY'S LESSON

There has been hardly a military campaign in the history of the world in which the belligerents have not been more or less hampered by a shortage of ammunition and supplies, either immediate or prospective. Thus in the present war, Russia on several occasions has been unable, in spite of ample personnel, to oppose successfully the German troops because of a shortage of material, and she has been compelled to forego success which might have been gained, and has been forced to sacrifice many valuable lives which might otherwise have been spared. Several of the great "drives" indulged in by various belligerents have fallen far short of a full measure of success partly because an inexhaustible supply of ammunition was not available.

Now it is true that we possess accumulated wealth and material resources exceeding those of any other nation, and our manufacturing equipment and methods are the greatest and most efficient in the world. If our advantages in these respects could be brought to bear we could furnish the materials of warfare at a rate with which no other nation could keep peace. Should we not take advantage of these circumstances to insure our success in case of war, and to purchase that success with the least expenditure of our most valuable possession—the lives of the nation's defenders? In other words, if a fighting man knows that he has an inherent advantage over all possible opponents in some one particular which they cannot evade, is he not wise if he develops this advantage to the utmost and then conducts the combat in such a manner as to make his advantage the determining factor in the result? Superior material alone cannot win battles nor compensate the lack of trained personnel, but its possession constitutes an advantage which, other things being equal, will determine the issue of the conflict.

Sir John French, late commander-in-chief of the British forces, says:

"The power of defense conferred by modern weapons is the main cause for the long duration of the battles of the present day, and it is this fact which mainly accounts for such loss and waste of life. Both one and the other can, however, be shortened and lessened if attacks can be supported by a most efficient and powerful force of artillery available; but an almost unlimited supply of ammunition is necessary, and a most liberal discretionary power as to its use must be given to artillery commanders. I am confident this is the only means by which great results can be obtained with a minimum of loss."

[*Next week Major Bond will conclude his series of articles by telling in what respects civil engineers and contractors are qualified to meet the military obligations of citizenship and what they may do to increase their efficiency.*—Editor.]

Philadelphia Trade Body Opposes State Regulation

Committee Formed to Study "Reasonable Regulation of Railroads" Makes Preliminary Report, and Invites Opinions

FEDERAL incorporation of interstate transportation companies, subjection of such companies to federal regulation only, and the reorganization of the Interstate Commerce Commission into district courts, composed chiefly of business men and railroad men, are among the changes suggested by the Philadelphia Bourse to a committee formed to study the "reasonable regulation of railroads."

A year ago, as the result of a conference of representatives of ten of the leading commercial organizations of Philadelphia, the Joint Committee on Reasonable Regulation of Railroads was formed. Subsequently a subcommittee was created, and the leading trades bodies throughout the country were asked their views on the subject. The views mentioned in the first paragraph are those of the Philadelphia Bourse, whose president, George E. Bartol, called the original conference.

"REGULATION MEANS RESPONSIBILITY"

The subcommittee has just submitted a report to the committee at large, and the latter body in giving out the report requests all trade and commercial organizations to give the subject careful consideration and advise the committee of any action or any views formulated. The committee does not make detail recommendations. It does, however, express itself in part as follows:

"Governmental regulation means the assumption by the government of responsibility for the success or failure of the railroads, for it is apparent that attempts at regulation which fail in appreciation of the true objective, in constructive method or in technique, may result in the complete disorganization of the roads.

"Regulation cannot be conceived from the narrow standpoint of merely reducing rates; that point of view loses sight of essential needs, both of the railroads and of the country at large, and must, in the nature of things, defeat its own ends.

"A proper view of governmental regulation must take into account the encouragement of railroad building and operation, the better mobilization of present facilities, and the modification of harmful competition, as well as the prevention of inequalities of service to the public, and the enactment of rates greater than those properly chargeable in an open competitive field.

"A proper system of regulation in this country must start with the conception that the railroads are the great highways of the nation, and that all barriers erected by the States, or however arising, which impede the natural flow of commerce along these highways must be removed.

"Finally, the single regulatory body,

through which alone coherent action can be obtained, must be so constituted as to handle, expeditiously and well, the great volume of business to come before it, a series of problems involving every phase of national life and activity."

Suggestions of Philadelphia Bourse

The conclusions of the Philadelphia Bourse, which are presented as suggestions, are in full as follows:

1. Legislation to be urged that will provide for federal incorporation of companies engaged in the interstate transportation of goods or persons.
2. All companies engaged in such business under charters granted by any state or territory, or the District of Columbia, to be privileged to accept federal charters without surrender of their state charter, and without impairment of the rights of the several states with regard to taxation upon property value of corporations within their borders.
3. All corporations accepting federal charters to be subject to regulation by the federal government alone, through the Interstate Commerce Commission.
4. The Interstate Commerce Commission to be reformed into district courts, one court for each freight traffic district, as now organized in the form of territorial freight traffic districts.
5. Each court to have a president judge (a jurist), three associate justices (business men), three associate justices (expert railroad men). The district courts to have full power to regulate the corporations operating under federal charters within their districts without appeal, except as to questions of principle.
6. The president judges to form a Supreme Interstate Commerce Court, sitting in Washington, to determine questions of principle of country-wide application.
7. The district courts to sit at some central point in their respective districts. To hold court for six weeks out of each three months throughout the year.
8. The Supreme Court to hold court for one month twice a year.
9. All decisions to be rendered within sixty days of final argument.
10. Definite limits to be placed upon the powers of the Interstate Commerce Commission along the lines of regulation of rates, corrections of inequalities and abuses, and arbitration of labor disputes, with such other features as a closer study of the subject may suggest.

International Power Transmission

International power transmission by submarine cable is now a fact, lines between Sweden and Denmark having been put in service in January. The cables run from Palsjo, just north of Helsingborg in Sweden, to Marienlyst, a village north of Elsinore, Denmark. The underwater distance is 3.35 miles, the transmission voltage 25,000, and the energy transmitted 5,000 kw. The two power cables are laid parallel to each other 100 meters apart, while a protecting steel cable, with a breaking strength of 40 tons, is run parallel to the power lines and 100 meters from the nearest. Iron towers 25 meters high on either shore, in line with the protecting cable, warn vessels against attempting to anchor. These towers carry green lights at night. There is a steam station on the Danish side to act as a reserve, in case of interruption on the submarine line.

Restricted Use of Term "Engineer" Advocated

Present Indiscriminate Practice Confuses "Engine Driver" with Technically Trained Man—An Opportunity for Editors

By N. M. STINEMAN
Office Engineer, Engineering Department, Chicago, Milwaukee & St. Paul Railway, Chicago

RECENTLY a controversy arose in the daily press of Chicago on the question of the meaning of the word "engineer." A man who holds a license as stationary engineer was appointed by the mayor of Chicago as smoke inspector, a position which clearly should be filled by a mechanical engineer. The supposition is that the mayor does not comprehend the distinction between a mechanical engineer and a stationary engineer. In connection with this appointment Arthur Kneisel, secretary of the American Association of Engineers, published an article in the *Chicago Daily News* in which he called attention to the fact that there is a distinction between a mechanical engineer and a stationary engineer, that the word "engineer" has a dual significance, and that this dual significance should be kept in mind when appointments of this kind are to be filled. Other engineers entered the discussion, and several articles were published before the matter came to a rest.

Improper Usage General

It is indeed unfortunate that in America most people associate the word "engineer" with a man in greasy overalls who runs an engine or a boiler. The man who operates the boilers of an apartment building is called an engineer, although, as we shall see in a moment, the name is entirely a misnomer when applied to him. He may be a good mechanic, but he is not an engineer. The gray-haired man who drives the locomotive of a trans-continental limited, and who holds the lives of hundreds of human beings in his care, belongs to the very highest type of mechanic; but he is not an engineer—except in the United States and Canada.

Much has been said and written on the importance of educating the public to the true meaning of the word "engineer." In this case, as in many others, it is of far greater importance that engineers themselves be educated to the true meaning. So long as engineers use the word improperly, how can they expect to educate the public to the true usage? So long as engineering magazines and text-books use the word improperly, how can we expect engineers to become entirely clear in its use? It seems obvious that the place to begin is not with the public, but with engineering literature —at the other end of the line.

Now let us investigate the words commonly used in other countries and other languages to designate the man who runs an engine and the man who is a civil engineer (using the latter in the broad sense). To begin with, other languages do not contain a word directly equivalent to the English word "engine." The word commonly used is analogous to the English word "machine," and the different types of engines are designated by proper modifiers. Thus, in French and German, respectively, a steam-engine is a "machine à vapeur" and a "dampfmaschine." In consequence, the man who runs a stationary engine is designated by a word analogous to the English word "mechanic" or "mechanician." Other languages do contain a word similar to the word "locomotive," to designate that particular type of engine. The word used to designate the man who runs a locomotive might, in most cases, be translated into English as "locomotive conductor."

Practice in Other Countries

The following table shows, in columns 2, 3 and 4, the words commonly used in various languages to designate the men who in this country are known as civil engineers, locomotive engineers, and stationary engineers, respectively:

Language (1)	Civil Engineer (2)	Locomotive Engineer (3)	Stationary Engineer (4)
French ...	Ingénieur	Conducteur de machine	Mécanicien
Spanish ..	Ingeniero	Conductor de locomotora	Maquinista
Italian ...	Ingegnere	Conduttore di locomotiva	Macchinista
German ..	Ingenieur	Lokomotivführer	Maschinist
Swedish ..	Ingeniör	Lokomotivförare	Maskinist
Danish ...	Ingeniör	Lokomotivförer	Maskinist
English (England)	Engineer	Engine driver	Engineman
English (U. S. and Canada) .	Engineer	Engineer	Engineer

From this table it is evident that in countries other than the United States and Canada there can be no misunderstanding as to the meaning of the word "engineer." Only in the English-speaking portion of North America is its use in a state of confusion. We have succeeded partially, though not entirely, in acquiring the habit of using the correct words in connection with the driving and care of automobiles. Why not correct ourselves in other respects? Nothing could be more logical than the forms used in England, where the civil engineer is known by his true name, the man who runs a locomotive is known as an "engine driver," and the man who runs or takes care of a stationary engine is known as an "engineman."

This discussion may be considered as a direct appeal to editors of engineering magazines and writers of engineering textbooks. When editors receive an article on construction work in which the writer refers to the man who runs the hoisting engine as the "engineer," they have it in their power to use the blue-pencil and to write in its place the proper word, "engineman." Editors have the power to cross out the words "locomotive engineer" and to write in their place the more logical words "engine driver." In reviews of new engineering books there is an opportunity to call the attention of the authors to any improper use of the word "engineer" which their books may contain. In this manner editors can gradually bring engineers themselves into the habit of using the words properly. Then, and not until then, can we hope to make any progress toward educating the public.

[*Comment on this subject will be found in the editorial columns.*—Editor.]

Exports to Argentine Increase 53 Per Cent in 1915

The United States ranked second in imports into the Argentine Republic in 1915. The total value was about $54,193,342, an increase of 53 per cent over 1914; this despite the fact that the total imports of the republic decreased 16.5 per cent.

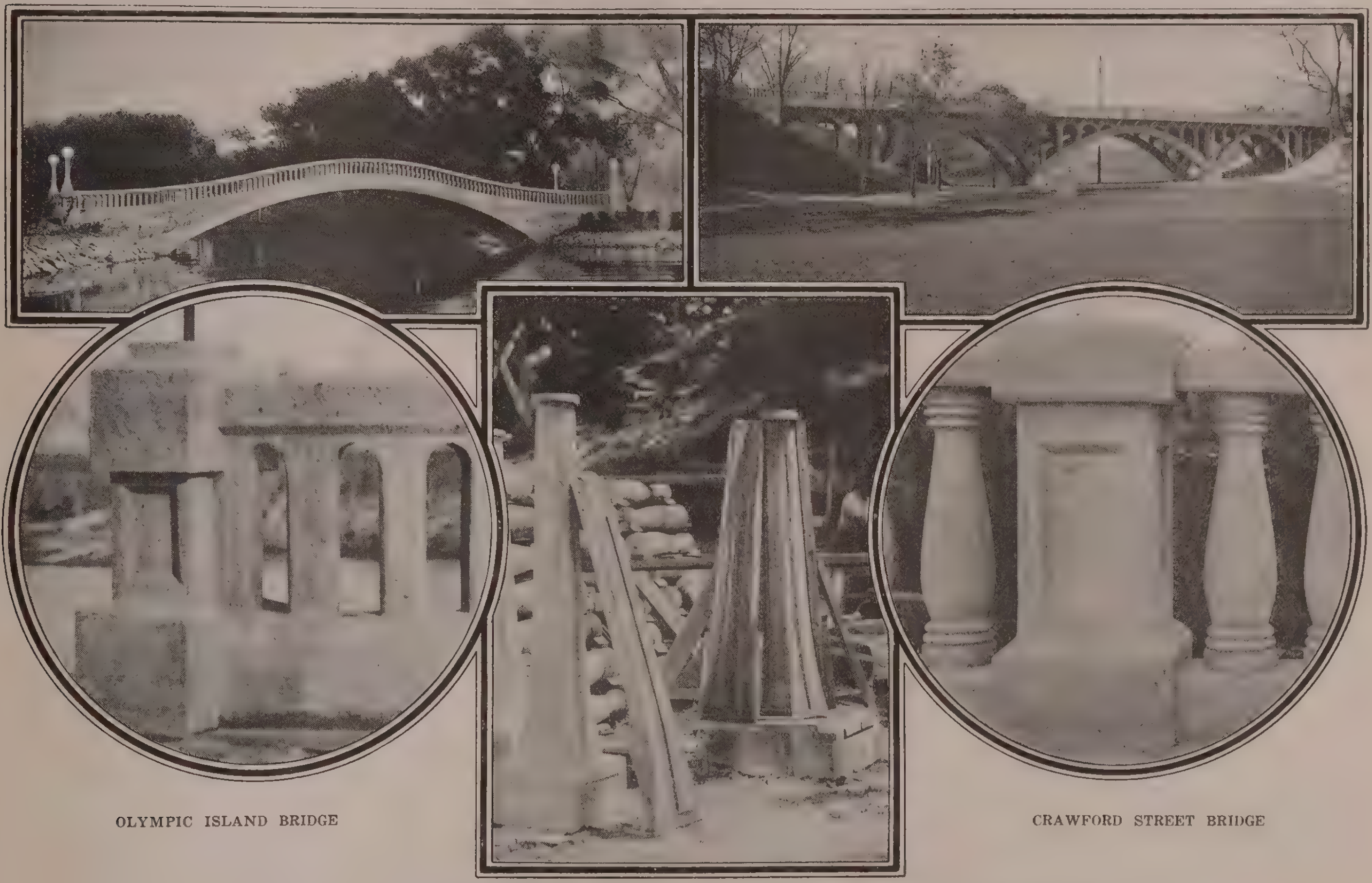
Concrete Balustrades Enhance Appearance of Bridges

Arch Bridges in Toronto Have Ornamental Sidewalk Railings—Molding and Finishing Methods Described

By L. N. EDWARDS

Railway and Bridge Section, Department of Works, Toronto, Canada

ONE of the most important and often the most troublesome of the details in modern reinforced-concrete bridge construction is the sidewalk railing or balustrade. Perhaps more than any other single part of the bridge, this detail must be properly ornamental and must please the eye of the casual observer. From his impression of its fitness he frequently passes judgment upon the beauty and strength of the structure as a whole. The two concrete balustrades here described are well adapted to their purpose, and have shown no spalling or cracking due to temperature changes. The details used in their construction are rather unique.


OLYMPIC ISLAND BRIDGE

CRAWFORD STREET BRIDGE

HOW THE CONCRETE SIDEWALK RAILINGS AND BALUSTERS ON TWO TORONTO BRIDGES WERE TREATED

OLYMPIC ISLAND BRIDGE BALUSTRADE

The Olympic Island bridge, built in Island Park, Toronto, to connect Center Island with Olympic Island, consists of a reinforced-concrete arch span having an overall length of 84 ft. The accompanying photographs show the completed structure with its concrete balustrade.

The concrete used in the balustrade is composed of cement and granite chips in the proportion of 1:2½, the coarse material of the chips passing a ¼-in. sieve, and the fine material serving as fine aggregate. A smooth surface finish of the cap and base was produced by rubbing with carborundum bricks until the granite aggregate was exposed. The intermediate or web portion was given a rough finish by the removal of the surface with a stiff wire brush, thus exposing the angular chips of granite. To add to the appearance the aggregate was composed of granite of several colors.

As a precaution against the cracking of the balustrade by the action of temperature or other deformations, three expansion joints were provided in the balustrade cap. These joints were made with four ply of asbestos roofing felt and were provided with a copper dowel to give general rigidity to the joint. This dowel was surrounded with two ply of felt at one end to prevent bonding in the concrete. For the verticals, two asbestos-felt joints were provided, one located at the top surface of the base, the other near the top of each vertical at the springing line of the semi-circular portion of the openings between verticals. Asbestos felt was used for these joints for the reason that its color closely corresponds with that of the concrete.

The balustrade above described has been in service two years, and gives no evidence of cracking in any of its parts. It therefore seems probable that this quite common defect has been, in this case, entirely overcome.

CRAWFORD STREET BRIDGE BALUSTRADE

The Crawford Street bridge over Bellwoods Park consists of three reinforced-concrete, open-spandrel arches with smaller approach arches, as shown in the accompanying photograph. The sidewalk balustrade used upon this structure is of concrete composed of cement and granite chips in the proportion of 1:2. All surfaces were ground by the use of carborundum bricks to give a smooth even finish, exposing the crushed granite aggregate.

The balusters, top rail and electric light pillars were molded and finished in separate units. The forms for the balustrade base were first constructed upon the sidewalk slab and after the base had been molded and finished, the forms were built for the balustrade posts and that portion of the posts below the post caps was cast. As soon as the concrete of the latter had taken a firm set the balusters and caps were assembled and the posts completed by molding the caps in place.

REINFORCEMENT

The ½-in. square twisted rods forming the reinforcing of the balusters and extending about 2 in. beyond their ends formed dowels which were embedded in cement mortar in holes provided in the caps and bases. All balusters were formed in lead-lined wooden molds and all caps and electric lighting pillars were formed in wooden molds. The balusters were finished by revolving in a lathe under a carborundum brick. All other portions of the balustrade were finished by hand rubbing.

In order to fully provide against possible cracking of the balustrade through temperature or other deformations, the ends of all caps and bases abut against two ply of asbestos felt, thus preventing adhesion between the concrete forming the posts and that forming the caps and bases, and rendering each panel section of the balustrade practically an independent unit.

The effectiveness of these provisions for expansion appear to be proved by the fact that slight movements have been observed, but no evidence of cracking or spalling has developed.

FOUR FLOODS, ONE HIGHER THAN THE STAGE OF WATER SHOWN, DID NOT STOP WORK ON PIERS FOR NEW BRIDGE

Foundations for Dayton Bridge Finished in Four Months Despite Four Floods

Caisson Piers for Pennsylvania Lines Bridge Sunk Through Old Masonry and Timber Mat While Water Rises Almost to Old Bridge

CONTINUING to sink caissons with the aid of gin poles and hoists mounted on top of the cofferdams after the river had drowned the derricks set up for the pier work and had almost reached the girders of the temporary bridge above, the Foundation Company completed two caisson piers and practically finished two abutments constructed in cofferdam for the new bridge of the Pennsylvania Lines over the Miami River at Dayton, Ohio, in the four months between Dec. 1, 1915, and April 1. Four floods, the first three of which occurred while the piers were under construction and practically reached the top of the old bridge piers, and the last two of which flooded the abutment cofferdams, prevented the completion of the work in a still shorter time.

TRUSSES TO REPLACE DECK GIRDERS

The old bridge, 641 ft. long, of 7 deck girder spans, was damaged in the flood of March, 1913, by the washing out of pier 4, counting from the east bank, and the tipping of pier 5. It was restored on pile piers, and is now to be replaced with a 3-span truss bridge of slightly greater length. The construction of the new abutments required the demolition of the old, which were spanned temporarily by girders on pile bents placed by forces of the railroad company. The same was done at pier 2, which fell at the site of the old tipped pier 5 and the pile pier which had been driven around it. Pier 1, however, fell between old piers 2 and 3. None of the work for carrying the double track main line was started until after the contractor's forces reached the site on Dec. 1.

CONCRETE CAISSONS EMPLOYED

This left pier 1 as the best place to start work. An island was thrown up on a sand bar, partly by wheeling from the east bank and partly by a grab bucket handled by the derrick set up on the down stream side to sink the caisson, and the oak cutting edge erected on it. Timber framing for the cofferdams to surmount the caissons, in which the pier shafts were built, went ahead while the work of building the forms, placing reinforcing and concreting the working chamber was completed. Concrete was mixed on shore and pushed out in buckets on flat cars on a cantilevered industrial track carried on outriggers slipped between the ties of the downstream track and kneebraced to the lower flanges of the downstream line of girders.

As the piers were started at elevation 724, about a foot above the average winter stage of the river, and sunk from 26 to 28 ft., and as there was about 18 ft. clearance between the islands and the lower side of the old bridge, but two buildups of cofferdam and one of shafting were required. Sinking was started on pier 1 Jan. 2, and air was taken off twenty-seven days later, after concreting the working chamber.

FLOODS DELAY START OF SECOND PIER

During this time two floods had interfered with the work of demolishing the old masonry of the tilted pier 5 and building an island at the site. Nevertheless, the second caisson was ready for air on February 3 and had been sunk and sealed thirty-one days later. As the old bridge did not offer any means of suspending this caisson the old pier was cut only to the water level before erecting the new cutting edge. It was found cheaper and quicker to use a steel cutting edge, and sink through the old masonry and the timber mat on which it rested, than to dredge out the old pier, most of which was under the bridge, and refill the site to make an island.

On top of the cofferdams for each of the caissons was set a hoist in addition to the derrick set on piles at each pier site. A gin pole leaned over the upstream air locks of each pier handled dirt buckets. At the first pier this rig was used during high water on both locks, using both drums of the hoist. The hoists and gin poles were raised once for each caisson when the air locks were raised. This was done by the derricks on

TRACK CANTILEVERED FROM GIRDERS OF OLD BRIDGE USED FOR CONCRETE AND DIRT CARS—RIVER 4 FEET ABOVE LOW WATER the lower side and by a locomotive crane on the upstream side.

The excavated material, which was gravel, clay and finally hardpan, was used for weight only on pier 1. On pier 2 the concrete was built up rapidly during sinking, and furnished enough weight. The dirt taken out with the gin poles was dumped around the piers. What did not wash away in the floods was barely enough to fill in around the piers when the cofferdam sections were unbolted above the working chambers and pulled out. All the other excavation, including that for the abutments and the weight removed before starting the shaft of pier 1, was dumped at the ends of the bridge and spread by wheeled scrapers on the levees, which were being strengthened at the time. The narrow gage track and dump cars were used to transport the dirt from the piers.

ABUTMENTS EASILY FLOODED

Each abutment was in the front face of the levee and consequently the steel cofferdams for them could not be protected from floods. Both cofferdams were very wet even at low river stages. The west abutment, which is founded on piles, was built with two derricks. The east abutment was founded on hardpan and the work on it was handled by one derrick and the crane. Both cofferdams were excavated to about 18 ft. below the prevailing water level.

The time required to complete the work was increased by the great quantity of old masonry and timber to be removed, which ran the total excavation up to more than 7000 cu. yd., or 2500 cu. yd. in excess of the total new concrete work. The remaining piers, two of which are concrete, stone faced, on piles, and the rest of which are stone on timber mats, will not be removed until the new bridge is in place.

The work has been carried out for the Pennsylvania Lines by the Foundation Company under the direction of John W. Doty, vice-president; M. L. Peppard was superintendent and Sam Snyder general foreman. For the Pennsylvania Lines the work was in charge of E. E. Stetson, assistant engineer, under W. C. Cushing, chief engineer of maintenance of way, Southwest systems.

Write to Geological Survey for Information on Rocks and Minerals

The U. S. Geological Survey answered 50,000 letters of inquiry last year concerning the earth's crust and what it contains. These letters asked not only about the geology of this country, but also about the rocks and minerals of foreign countries. More and more inquiries for information about our mineral resources are coming from South and Central America.

The Survey is in close touch with the 90,000 producers of minerals in United States and is ready to answer questions about the annual production of 70 different minerals or mineral products. Furthermore, the Survey knows the places in the United States where more than 425 different minerals may be found, so that it is in a position to act as a public agency in bringing the mineral producers and consumers into touch with each other. The Survey can make simple mineral determinations and give information as to the identity and use of minerals submitted to it. All inquiries should be addressed to the Director, U. S. Geological Survey.

Grouting An Effective Remedy for Stopping Leakage During Shaft Sinking

Second Article in Series Describing How Difficulties on Catskill Aqueduct Shafts Were Overcome by Injections of Cement and Sand

By JAMES F. SANBORN
Division Engineer, Board of Water Supply, New York City

[In the first of this series of articles, published last week, Mr. Sanborn explained the general principles which should govern grouting operations, selection of equipment, and methods of cutting off leakage in tunnels. The second article, this week, recites in detail the difficulties in shaft-sinking on the Catskill aqueduct, and how they were overcome—Editor.]

AT HIGH FALLS, N. Y., a wet shaft was sunk about 500 ft. for the construction of the Catskill aqueduct. The shaft was 10 x 22 ft., with the usual rectangular timber. The strata penetrated were as follows: 6 ft. of glacial drift, 260 ft. of Helderberg limestone; 39 ft. of Binnewater sandstone, 39 ft. of High Falls shale and 134 ft. of Shawangunk grit.

Immediately on the site of the shaft a shot-drill hole 4 in. in diameter had been sunk to the Shawangunk grit and a smaller diamond drill hole continued through the hard grit to the foot of the shaft. Water under pressure was struck in the Binnewater sandstone, a very fine grain rock, generally porous, with numerous open seams. The High Falls shale is a rather soft rock, much broken up at the site of the shaft, while the Shawangunk grit is an exceedingly hard and brittle white quartzite, intersected by numerous narrow seams bearing water.

LARGE LEAKAGE ANTICIPATED

Pumping experiments made before sinking the shaft indicated that a great deal of water would be encountered, and the contract made provisions for a pumping plant having a capacity of 1800 gal. per minute. The shaft was sunk through the limestone without difficulty. At a depth of 80 ft. water rushed in through the 4-in. bore hole at the rate of 600 to 800 gal. per minute and the shaft was flooded.

After additional pumps had been installed and the bottom of the shaft recovered, the bore hole was grouted through a 1-in. pipe extending to the conglomerate bed, a depth of about 360 ft. Before grouting, the shaft was allowed to fill up with water to equalize the pressure in order to prevent the washing out of the grout by entering water. Sinking through the limestone was almost all in the dry, and excavation was rapidly advanced.

At a depth of 215 ft. water was struck in the Binnewater sandstone, and at a depth of 260 ft. the shaft was making 225 gal. per minute. At this depth an additional flow of about 600 gal. per minute came in through one of the drill holes and again flooded the shaft. It was slowly pumped out and an attempt made to grout the water-bearing seams, but, owing to breakdowns of pumps, the shaft was again twice flooded. The holes were drilled through pipes provided with valves, swedged firmly in the rock, so that a sudden flow encountered in the drill hole might be shut off. Leakage from the sides and around the pipes in the bottom of the shaft amounted to 450 gal. per minute. After three weeks of pumping, drilling was resumed.

At this time it was discovered through the evidence furnished by the drills that for the next 8 ft. the ground to be excavated was extremely soft and porous, with open seams of a maximum width of 8 in. The largest seam was at one point within 18 in. of the rock bottom of the shaft, at which point the water leaked freely through cracks, indicating that when the rock was shot there would be a great inflow of water, which, it was feared, could not be handled by the pumps.

SIX GROUT TANKS USED

Grouting was accordingly undertaken to cut off all water-bearing seams in the rock. Since the stratification was horizontal and the bedrock of limited thickness, it was hoped that by grouting off the seams the water would not follow the work down, and again appear at the bottom as excavation progressed. A battery of six Canniff tanks was placed on the surface and the grouting carried on through a 2½-in. pipe leading down the shaft with a 2-in. hose connected at the bottom. The grout from the first holes leaked back into the shaft around the pipes and through seams in the bottom, and it was thought that a concrete blanket might be necessary to make the grouting successful, but on account of the inward leakage the difficulty of placing a watertight layer of concrete would have been great.

After numerous experiments ground horse manure was injected with the grout, finally clogging the openings and making the seams in the bottom fairly tight. In three days 2900 bags of cement were forced in and the holes closed off. After the grout had set, additional holes were drilled and struck water under pressure at a depth of 14 ft. These holes were next grouted and took 60 bags of cement.

100-FT. HOLES GROUTED

In view of the success of the grouting it was decided to put down diamond drill holes to the top of the conglomerate, a depth of about 100 ft., and attempt to grout the ground to that depth. Six holes were drilled, 3-in. in diameter for the upper 5 ft. in which pipes were secured and provided with gate valves at the top. Through these valves three diamond drill holes 1-in. in diameter and three holes 2-in. in diameter were sunk. At a depth of 50 ft. water was encountered. After completion, the holes were grouted, and took 175 bags of cement at a pressure of 275 lb. per square inch.

After a total delay of four months, sinking was resumed. In the first 15 ft. excavated numerous well grouted seams, with a maximum width of 8 in., were passed. Below this point no large flows of water were encountered, but the seepage from the sides increased. At a depth of 280 ft. the shaft was making 350 gal. per minute, and at a depth of 320 ft. the flow was considerably more than 600 gal. per minute.

It is the opinion of W. L. Canniff, expressed to the author, that many of the small leaks encountered through the ground penetrated by the diamond drill holes might, perhaps, have been cut off by the grouting if, instead of attempting to grout the full depth of the holes at once, the holes had been sunk 20 ft. and then grouted, before again drilling another 20 ft. and grouting. However, as the holes drilled at shaft 4 were small, and were not reamed to remove cuttings, there is no certainty that grouting before completing the drilling would have been of much advantage.

During all the work at shaft 4, in addition to the troubles incident to pumping the water, hydrogen sulphide gas, with which the water was strongly charged, made it exceedingly disagreeable for the men working in the shaft. The gas caused painful inflammation of the eyes, necessitating at times the changing of shifts every three hours. In many cases the men were forced to leave the work for several days.

Pilot Drill Hole in Shaft

At a depth of 320 ft., a considerable flow of water, from a pump chamber excavated in the side of the shaft where the grout had not penetrated, increased the total pumping to a maximum of 725 gal. per minute. Below this elevation a pilot drill hole was kept well below the bottom and all seams were grouted, none of them taking more than 50 bags of cement. All drill holes showing water in any quantity were grouted with fairly good results in cutting off the leakage.

In several cases the nipples through which the holes were drilled were wrapped with flannel before being driven in, a practice which was common at the Detroit salt shaft, which was sunk by the grouting method. Wooden wedges, oakum and cement were also used for the purpose of confining the grout pipes. Horse manure was added to the grout in a number of cases.

In grouting the holes, a weak grout was used at first, and the quantity of cement was gradually increased; if the grout continued to flow freely, sand was added, until the pipe began to clog. The grout injected into the rock set very slowly and seemed to develop little strength, although serving to seal up the seams. A total of 971 bbl. of cement was used in the grouting.

While in this case the grouting did not serve to cut off all the water, and great expense was necessary to keep the shaft dry by pumping, it is felt by those familiar with the conditions which existed that the sinking of the shaft was very much advanced by the grouting method employed.

Shafts in New York City

Shaft 4, on contract 63, a concrete-lined shaft of the Catskill aqueduct in New York City, was sunk a depth of 240 ft. in Fordham gneiss, a rock generally sound and hard. The shaft was dry to a depth of 150 ft., when a flow of 150 gal. of water per minute was encountered while drilling. In a few hours the quantity diminished until there was a constant flow of 50 gal. per minute. After pumping out the water which flooded the shaft, the drill holes were plugged, and the concrete shaft lining was placed to within a few feet of the bottom of the excavation.

The drill holes were next grouted, using neat cement in the proportion of about 15 lb. to each gallon of water, by means of a Canniff tank and air pressures from 100 to 225 lb. per square inch. In this grouting, 46 bags of cement were used and the leakage was completely cut off.

Sinking was resumed without incident until at a depth of 181 ft. water was struck under a pressure of 70 lb. per square inch. The maximum flow was not determined, as the holes were plugged when they were drilled, and the flow from each was cut off by grouting as before. Pilot holes 14 ft. long were then drilled, and all struck water, in some cases carrying fragments of rock 1-in. in diameter. The material washed from the drill holes indicated that the water must come from a badly disintegrated seam. The 14-ft. holes were grouted, but did not take much cement, which left a doubt as to the sufficiency of the grouting. The shaft, however, was sunk 5 ft. without increase of water, exposing a 2-in. seam well filled with grout.

The bottom of the shaft was in disintegrated rock well grouted. A number of 16-ft. holes, 18 in. apart, were drilled around the rim of the shaft, and grouted, one at a time, as they were sunk. Each hole took about 2 batches, except those on one side of the shaft, which leaked at the rate of 100 gal. per minute and could not be made tight. This leakage was cared for by the pumps, as compressed air from the powerhouse was then available, and no more grouting was done. As sinking continued there was no further increase of leakage, and sound rock was struck at a depth of 200 ft.

Crushed Zone Encountered

The water-bearing ground penetrated by the shaft at a depth of 181 ft. showed a crushed zone of gneiss with a maximum thickness of 8 ft. on one side, disintegrated below for an additional depth of 4 ft. This fault plane dipped south, and was afterward struck in the tunnel, where the roof broke high for over 100 ft. and water flowed from the seam. When the tunnel was lined the flow from the seam was carried in pipes through the concrete, and was successfully cut off by grouting at a pressure of 300 lb. per square inch. Several holes were drilled into the seam from the tunnel before the concrete lining was placed in order to grout it as completely as possible.

As shaft 4 is a permanent waterway shaft, it was decided not to depend entirely upon the grouting of the surrounding ground. The thickness of the concrete shaft lining was increased to an average of 29 in. for some distance above and below the fault, heavily reinforced with horizontal and vertical bars.

Regarding the success of the grouting it is to be noted that the disintegrated ground was found well impregnated with grout, but the leakage was still 100 gal. per minute. After the shaft lining was placed and the water-bearing pipes grouted, the shaft made but 3 gal. per minute.

In the seam first struck, at a depth of 150 ft., it was found on examination of the rock after excavation that the water-bearing seam was well filled with cement, and the water cut down from 50 to 15 gal. per minute at that time, some of it coming from other parts of the shaft.

In the disintegrated fault zone near the bottom of the shaft, however, where about 1,000 bags of cement were injected through many holes, there was still an inflow of 100 gal. per minute, although hard set grout was found, filling spaces 1 ft. or more thick, and from that size down to cracks 1/16 in. or less in width. All this was thick grout. In this shaft more than 100 holes were drilled for the grouting operation, and a great deal of work was done in an effort to cut off the water. Over a month was spent in the grouting work at the lower seam.

From the experience at this shaft it appears that in the first seam struck, which was a perfectly definite opening almost all in one plane, the grouting was successful in cutting off the water permanently after a few shifts spent in grouting, but in the wide fault zone with its many seams, large and small, filled with soft and disintegrated gouge, even after the expenditure of much time in grouting the flow of water was not entirely controlled.

On contract 67 of the Catskill aqueduct, on the lower east side in New York and Brooklyn, grouting was used to cut off water during excavation in four shafts sunk in rock. These shafts were all lined with concrete and made as nearly as possible watertight by grouting the water-bearing seams. At all times on this contract pipes and valves were kept ready for controlling the flow from drill holes tapping water as the sinking proceeded, and grouting equipment was prepared to meet any such emergency.

If the shafts had been lined with timber and had no grout been injected, it is likely that the trouble from water would have been very much greater than it was.

Concrete Blanket in Shaft to Hold Grouting Pressure

Shaft 20 was sunk in Fordham gneiss without much water. In sinking this shaft a few small flows of water were encountered, which were cut off without difficulty by the concrete lining, but at a depth of about 425 ft. an inflow of 30 gal. per minute was encountered in the drill holes in the bottom of the shaft. Five days afterward this water had been cut off by the grouting method, which was as follows: Long holes were drilled in a concrete blanket 2 ft. thick, placed over the rock before grouting was started. Before the blanket had set the holes were drilled and another 2-ft. layer of concrete was placed. After 48 hr. grouting was undertaken at a pressure of 300 lb. per square inch and the water cut off. After the grouting, this shaft was sunk without difficulty and very little water was encountered in the seams.

Shaft 21 was sunk in granodiorite to a depth of 750 ft. below the East River. The rock was hard, seamy and rather wet, with wet zones about every 60 or 80 ft., which were grouted in every case with considerable success. At one place a concrete blanket, as in the case at shaft 20, previously mentioned, was built over a seam to hold the grouting pressure, and proved successful. The concrete lining was built in stretches of about 50 ft. as the sinking progressed and the water coming through the lining was grouted off in order to keep the bottom as dry as possible.

Valved Pipes Control Flow

Shaft 22, in Brooklyn, was sunk through gneiss and granodiorite, in rock carrying only a few small flows of water, except in the case to be described, where water-bearing seams were grouted through drill holes sunk in the bottom of the shaft.

At El. — 430 a flow estimated at over

200 gal. per minute was encountered in a drill hole. A pipe carrying a valve was immediately driven into the hole, the flow controlled, and other holes, 5 to 20 ft. deep, were drilled to locate the extent of the area bearing water, which was found on one side of the shaft. On account of the great number of seams in the rock a first attempt to grout was unsuccessful. After building a concrete blanket around two of the pipes in the wet portion, the water was cut off on a second attempt, using a pressure of 350 lb. per square in., only six days after the water was first struck. Subsequent excavation showed that the water was all cut off, except 20 gal. per minute, which was eliminated after placing the concrete lining.

FINE SEAMS FILLED WITH CEMENT

At one of the holes grouted seams not over 1/16-in. wide were completely filled with cement. These seams were sharply defined breaks in hard rock, and so intersected as to provide a good opportunity for circulation of the grout, with the result that the operation was successful with only a few shifts lost.

Shaft 24 of the City aqueduct tunnel was sunk through 200 ft. of granodiorite and gneiss with a sand cover 100 ft. deep below water level. The rock was blocky, seamy and more or less crushed. The grouting reduced the shaft leakage to 25 gal. per minute. During the next week the leakage increased to 41 gal. per minute, and on the week following to 50 gal. per minute, all from the seams which had been grouted.

Subsequently, in the neighborhood of the seam at El. — 196, the ground began to scale badly, with danger to the men working below. The flow of water increased. Both the increase in leakage and the scaling of the rock must have been due to an accumulation of ground water head, following the sealing of seams by grouting.

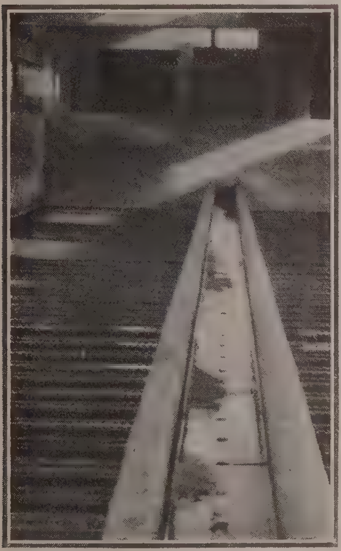
After lining the shaft with concrete, and grouting off the leakage from the pans and pipes, sinking was resumed. Although 20-ft. pilot holes were drilled on each round in preparation for grouting, no considerable flows of water were subsequently encountered.

[*Next week—Grouting tunnel headings in bad ground.*—Editor.]

Sewage Filters Have Unique Distributing System

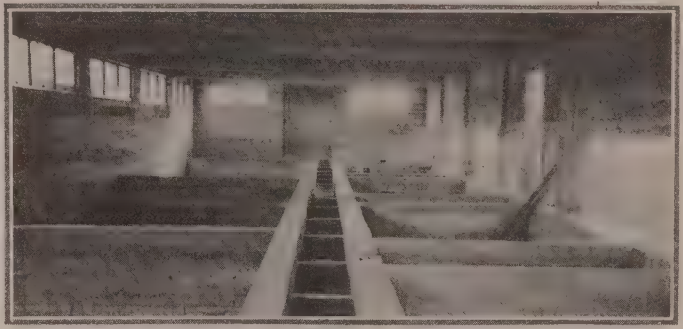
Cast-Iron Troughs with Scalloped Edges Spaced 6 Inches Apart Cover Surface of Stone Filter at Pana, Ill.

SCALLOP-EDGED cast-iron troughs 6 in. apart distribute the sewage over the trickling beds of the new 200,000-gal. daily sewage treatment works at Pana, Ill. The plant consists of a settling tank of the double compartment type, with a detention period of from 1 to 2 hr., automatic dosing tanks, a trickling filter, a secondary or humus tank and a sludge-drying bed, all designed to care for the sewage from 4000 people. The plant has just been completed and was described Jan. 27 in a paper by A. C. Stanfield presented before the joint meeting of the Illinois Society of Engineers and Surveyors and the Illinois Section of the American Waterworks Association. The following notes are taken from this paper:



CAST-IRON DISTRIBUTORS HAVE SCALLOPED EDGES FOR FEEDING SEWAGE TO FILTERS

FACTORY TYPE OF CONCRETE COVERS ENTIRE PLANT



COVERED TWO-STORY TANK FEEDS FILTER AT RIGHT BEYOND PARTITION

SMALL PIPES UNDER INFLUENT CONDUIT SUPPLY DISTRIBUTING TROUGHS NOT YET PLACED

The trickling filter is 60 ft. wide, 90 ft. long, and 7 ft. deep. It is surrounded by concrete walls and rests upon a concrete floor having corrugations to form drain channels. The channels are covered by large stone to prevent the entrance of small stone and discharge into a larger drain which has an outlet into the secondary settling basis. On the floor of the filter is placed a layer of stone ranging in size from 6 to 8 in. set on edge by hand, and on top of this layer is 5½ ft. of 1¼-ft. to 2-in. stone and on top of this a final layer of ½ to 1-in. stone.

The distributing system consists of five main concrete troughs running from the dosing tanks across the filter, each trough supplying one-fifth of the filter. These troughs are reinforced and supported upon concrete piers resting on footings beneath the floor of the filter, and each trough is provided with fifty-six 1-in. feed pipes in its bottom, spaced equidistant along its center line. Each pipe has a horizontal tee on the bottom, providing two openings into the distributing trough beneath. Immediately below the feed pipe and running at right angles therewith, are placed cast-iron distributing troughs. These troughs are 2 in. deep by 4 in. wide at the top and 3 in. wide at the bottom. On the outside of each wall of the trough, placed ½ in. below the top edges, projects a ledge having a scalloped edge from which the water drops 8 in. to the stone below. The top edges of the sides are notched with triangular notches ½ in. deep and spaced 1 1/3 in. apart. These troughs are about 6 in. apart and rest upon concrete beams supported by columns.

The openings to the feed pipes in the bottom of the main troughs were formed of 1-in. galvanized pipe, but these were found to be too large and they were reduced with lead bushings to 9/16 in., giving a more uniform distribution throughout the whole length of the trough. The total area of the filter, less deductions for columns, is 1 1/3 ft. per capita, based on 4000 population to be served.

ROOF OVER PLANT

The tank and filter are entirely inclosed by a reinforced-concrete building 86.5 x 93 ft., designed to furnish good light and ventilation, to protect the filter from low temperatures, and from débris being deposited upon it. The structure is fireproof except the doors and windows. All windows are protected by heavy wire screens. The outer walls have a pebble dash finish, and the roof slabs have a sidewalk finish painted with Weatherwear paint. The Kahn system of reinforcing was used throughout and the cast-iron distributing troughs were furnished by the Paris Machine & Foundry Co., Paris, Ill.

Including land, legal fees, engineering and supervision the plant cost $31,000, or an average of $7.75 per capita.

The W. S. Shields Company of Chicago, was the designing and consulting engineer and Mr. Stanfield had charge of construction.

Lincoln Highway Completely Marked

Since the beginning of work in 1914 on the 3384 miles of Lincoln Highway it is estimated that $2,250,000 have been expended. For all practical purposes the road is now completely marked from New York to San Francisco. The main part of the improvements are in New Jersey, Pennsylvania, Ohio and California.

Meter and Pumping Costs in Detroit

Theodore A. Leisen Gives Costs of Meter Setting and Testing, Results of Bleach Application and Unit Cost of Laying Pipe

THE consumption of water in Detroit in 1915 increased 9.4 per cent, but the population increase was 14 per cent. The average daily consumption was 162 gal., a reduction in the per capita rate of 5.4 per cent, as compared with 1914. However, the reduction must not be attributed to increase in the use of meters, according to Theodore A. Leisen, general superintendent of the waterworks system, in the latest annual report, because the increase in metered services was largely in the last few months of the year—too late to have an appreciable effect on the consumption. Through metered services passed 44 per cent of the total amount and they furnished 50.6 per cent of the revenue. Deducting the water used for industrial purposes the domestic consumption was 106 gal. per capita daily.

At the peak hourly load June 28, the rate was 50 per cent in excess of the average. The fire department records indicate that 0.04 per cent was used for fire purposes.

METERING

During the year a campaign for metering all services resulted in placing 5000 meters on old services. A total of 15,042 meters was set and 2913 removed, making a total of 29,180 in service. The cost of installing and testing meters is given in Tables 1 and 2.

TABLE 1—COST OF INSTALLING METERS IN DETROIT

Size in inches	Average labor and cartage	Average material	Average cost
⅝	$0.76	$5.22½	$5.98½
¾	0.76	7.82½	8.58½
1	0.76	10.15	10.91
1½	1.69	21.50	23.19
2	1.69	35.50	37.19

TABLE 2—COST OF TESTING METERS IN DETROIT.

Sizes in inches	Number	Flows—Full to	Average cost
⅝	6276	1/16	$ 0.05½
¾	4827	1/16	0.07
1	830	1/16	0.08
1½	99	⅛	0.47
2	77	⅛	0.47
3	35	⅛	2.10
4	25	⅛	2.10
6	6	⅛	2.10
8	1	⅛	3.36
16	1	1	13.40

PUMPING STATION RECORDS

The actual station duty of all engines was 95,923,000 ft. lb. per 100 lb. of coal burned, an increase of nearly 8 per cent over the previous year. The cost of pumping 1,000,000 gal. was $3.12, 22 cents less than the previous year. The cost per 1,000,000 gal. raised 100 ft. is segregated as follows: Labor, $1.24; fuel, $1.09; oil and supplies, 5 cents, and miscellaneous, 14 cents.

TABLE 3—COSTS PER FOOT OF LAYING WATER MAINS IN DETROIT, 1915.

Size in inches	Material, etc.	Labor	Overhead charges	Total
6	$0.57	$0.32	$0.04	$0.93
8	0.71	0.35	0.04	1.10
10	0.98	0.58	0.08	1.64
12	1.27	0.78	0.10	2.15
16	2.19	1.40	0.18	3.77
24	4.20	3.30	0.43	7.93
36	6.12	3.93	0.52	10.57
48	12.63	6.88	0.59	20.40

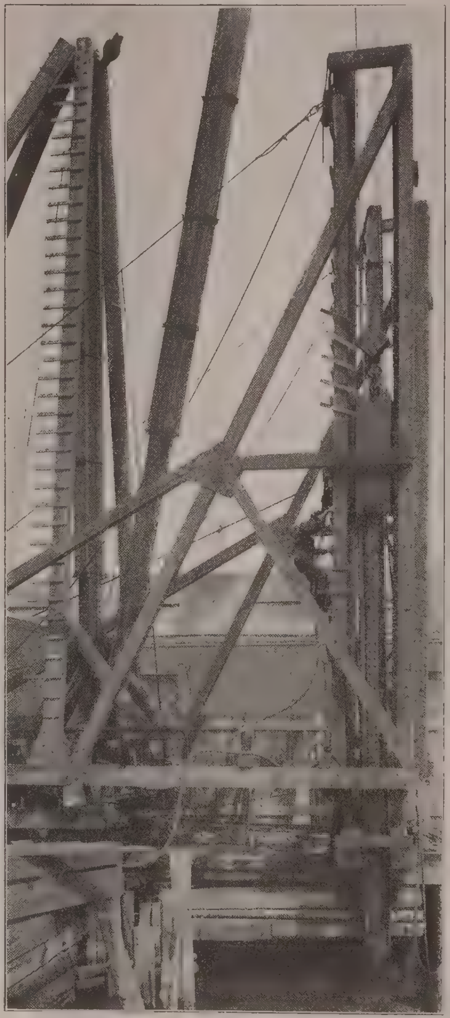
Bleach at the average rate of 6 lb. per 1,000,000 gal. resulted in the practical elimination of evidence of the colon bacillus in the treated water. On gelatine at 20 deg. C. the river water count was 218 per cubic centimeter and the treated water, 19. In the river water B. coli tests were positive on 20 days in 1 cu. cm. samples and on 123 days in 10 cu. cm. samples. In the treated water the tests were positive on 1 and 5 days respectively for 1 and 10 cu. cm. samples.

During the year 42.14 miles of new mains were laid at the unit costs as shown in Table 3.

Shore End of Narrows Siphon Built in Open Trench Dredged to Depth of 50 Ft.

Steel Sheeting of New Design, Driven by Special Traveler, Encounters Riprap and Boulders—Six Divers Employed at One Time

DRIVEN to grade and position with great accuracy, the steel sheet piling in the unusual trench for the Staten Island end of the Narrows siphon of the Catskill Aqueduct in New York City required some unexpected bracing and a good deal of diving work while it was being dredged out. This is thought to be due neither to the driving methods nor to the design. Boulders and riprap encountered at considerable depth in driving a few of the bays forced the sheeting into the trench, giving the arcs in these bays a greater length at the bottom than at the top and pulling apart one interlock in each of them. After timber frames had been set close to the sheeting to take the tension that would otherwise have been transmitted to the master piles through the interlocks of the sheeting, the excavation was completed, the skidway for placing the pipe built by divers and the pipe laying begun at the shore end of the trench, sliding the pipe down the incline as outlined in the article on page 513 of the Engineering Record for April 15, 1916.



MASTER PILES DRIVEN IN LEADS ON CANTILEVERED FRAMES

SPECIAL TRAVELER FOR HEAVY PILES

The first master pile was driven at the inshore end of the trench on Aug. 13, 1915, by the special traveler shown in the accompanying photograph. This traveler was equipped with a 78-ft. boom and a pair of vertical timber guides in which each master pile could be set, and through which the hammer followed the pile as in a pair of leads. The piles, all of the United States type, were blocked from these guides and kept in a vertical position, none of them landing more than 6 in. out of plumb. All but one of the master piles were driven within a fraction of an inch of grade. Driving on this one was stopped a few inches high because the pile had begun to twist. Only one pile went so far out of line as to require pulling and redriving.

The traveler was first erected on falsework built close to the shore to avoid blocking a private right of way. When sixteen master piles had been driven, the regular traveler track was built on them and the traveler, which weighed 48 tons, was picked up by one of the contractor's big derrick boats, turned around and set on this track. The traveler then finished driving the master piles, the last of which were in place by Sept. 30, when the guides were removed from the rig.

DRIVING THE SHEETING

Next the sheet piles for the flared ends of the structure were set and driven to grade and the traveler began to back up, setting and driving the intermediate sheeting as it went. To increase the speed of this part of the work a derrick boat began at the same time setting and driving the intermediate sheeting mid-way of the structure, working from its south side, and a stiffleg derrick was set up at the shore end to handle and drive the shorter sheeting used at that point. A 5000-lb. McKiernan-Terry hammer was used in driving some of the master piles, a 7500-lb, hammer of the same make being substituted later. A 4800-lb. Hamilton hammer was used largely in driving the intermediate sheeting.

MANY OBSTRUCTIONS MET

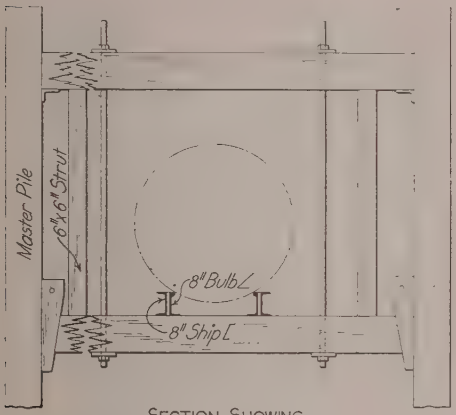
An old crib, brick footings and a quantity of heavy riprap, requiring blasting and dredging, considerably delayed the progress of driving the master piles. The progress made aside from these delays was a pair of these piles a day. The bottom, consisting of tightly-packed sand and gravel, was not favorable for driving, and some of the master piles required fifty blows to the inch

THREE RIGS WERE USED AT ONCE TO HASTEN WORK OF DRIVING INTERMEDIATE SHEETING

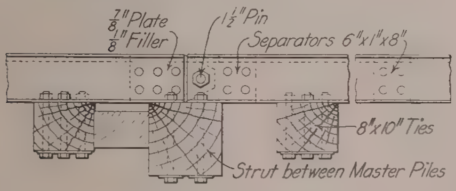
at the last, even with the use of two or three jets per pile. The character of the ground penetrated is shown in the accompanying photograph of the lower end of the only master pile which was pulled. The jets used carried a pressure of 100 lb. at the surface, and most of them were made to 2-in. pipe or smaller. They were also extensively used to jet down the sheet piles, 10 to 15 ft. of penetration being secured with many of these by raising and dropping them and jetting before the hammer was set on them.

GRAB BUCKETS DO EXCAVATING

The sheeting was practically all driven by Nov. 18, and the work of excavating and bracing the trench begun. The traveler was dismantled, and the trench excavated to grade by the stiffleg derrick and a dredge boat, using grab buckets. After experimenting with several types, an extra-heavy Williams clamshell was found to be far superior for this work, according to the contractors, a 1¼-yd. and a 2-yd. bucket being used throughout. As the excavation progressed, the cross struts were put in by divers. In addition to the shelf angles provided for seating these cross struts, plates bent in the shape of a Z were used on the ends of those struts which supported several master piles that had turned slightly in driving. This was done by having a diver take a template at each of these places at the level of the shelf angles. The struts were then framed to the templates, allowing for the thickness of the plate. The plates were bolted to the ends of the struts so that the bent edge of each plate which engaged the master pile made an acute angle with the face of the plate which bore against the pile. This made it impossible for the struts to slip out sidewise, and unnecessary to wedge them or put any strain on the connection to the seat angles.



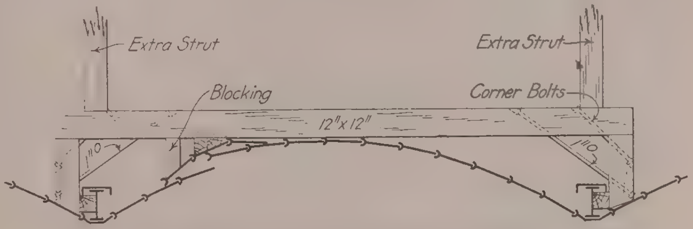
SECTION SHOWING METHOD OF HANGING PIPE



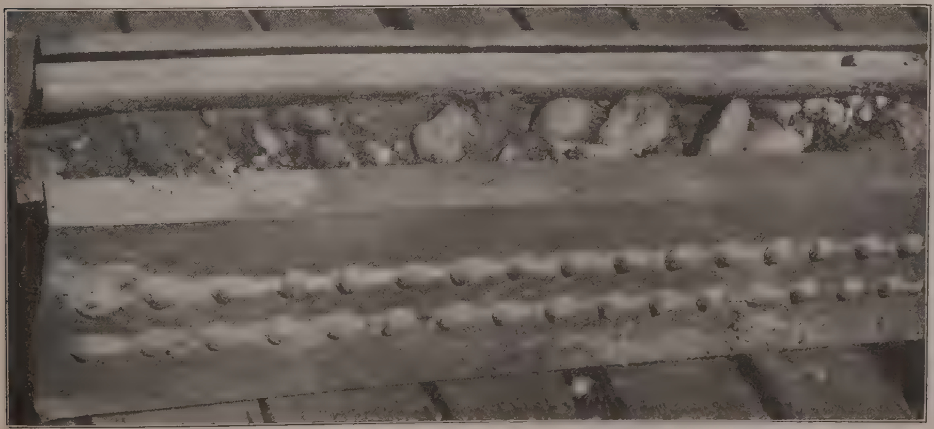
DETAIL OF GUIDES

TRACK AND LOWER BRACES LIFT IN PLACE UNDER PIPE

As the excavation progressed it was found that in four or five days the interlock had parted near one of the master piles. This condition is one which it is thought could not be avoided. Standard pile sections 60 ft. long are limber, even when threaded in an arched sheet. Boulders or large riprap stone were struck well below the surface in each of these bays in such a way as to deflect the sheeting in toward the trench, making the distance along the sheeting from one master pile to the other greater at the bottom than at the top, where the piles had been threaded. As the ground was very stiff and under a good pressure from material above, the tension in the arched sheeting could not possibly force the ground aside, and something had to give. The gaps thus caused were closed by driving two or three sheet piles over them inside the trench. This served better than driving them outside, where they would have struck some of the obstructions that caused the original break, and was much quicker. To take the tension which should have been transmitted along the structure by the chain action of the sheeting, as explained in the article above referred to, trussed timber frames like that shown in the accompanying sketch were used. These frames left the center of the trench unobstructed and furnished a support to the extra sheet piles driven to cover the holes. They were set as the excavation progressed, and did not greatly delay the work, although a separate template had to be made for each of them.



TIMBER FRAMES TOOK TENSION WHERE INTERLOCKS PARTED



COMPACT GRAVEL, SHOWN ADHERING TO ONLY PILE YET PULLED, MADE DRIVING DIFFICULT

PLACING THE SKIDWAY

These operations left the trench unobstructed for placing the pipe skidway according to the original plans. This skidway, the construction of which is shown in the accompanying drawing, was placed by the divers. The pipe laid in it is being handled by the stiffleg derrick. As may be remembered from the drawing published in the article referred to, a long stretch of this skidway at the outer end is level. It is planned to hitch a heavy tackle between the end of the completed line and the outer end of the section being laid in the trench, luff the main fall of a derrick boat through this tackle and pull the sections together as the lengths of pipe are added on shore. The joint being used in the line was tested to destruction in tension to determine the possibility of pulling the pipe in this way, and showed a strength almost equal to that of the pipe itself. If the pull required becomes excessive, the section of the line in the trench can be dragged to place in halves, and two joints made under water. On two lengths of this pipe a long, tapered spigot has been cast to facilitate entering the pipe at these joints.

When this has been done the skidway, which is hung by bolts from the braces above, will be unbolted by divers. The struts below the skidway do not rest on shelf angles, being merely wedged to the master piles. The wedges will be knocked out and these struts left permanently in the ground as a support to the pipe line. The trench will then be backfilled above the pipe, and the upper braces and their shelf angles taken out as the filling progresses. This will leave the entire system of sheeting clear for pulling with inverted hammers and other means.

The Narrows siphon is being constructed for the Board of Water Supply of New York City by the Merritt & Chapman Derrick & Wrecking Company. J. Waldo Smith is chief engineer and Alfred D. Flinn deputy chief engineer of the Board of Water Supply, for which Edward H. Hopson is resident engineer under John H. Hogan, division engineer, and Walter E. Spear, department engineer. William L. Chapman and Ralph E. Chapman of the contracting firm planned the construction work, which was carried out under the personal direction of the latter with Captain Tooker in charge of the work.

Various Aggregates in Test Concrete Road

City of Philadelphia Constructs 2-Mile Pavement on Oxford Pike to Make Comparison of Latest Theories and Practice

FOR the purpose of comparing the latest practice and theories of concrete road building, the city of Philadelphia last year completed a test road on Oxford Pike, 11,250 ft. in length and 18 ft. wide. It is subdivided into five principal sections, each 2250 ft. in length and consisting of a different composition of concrete. Bituminous wearing surfaces about 1/4-in. in thickness were placed on one-half of each section. The following details in regard to the construction have been abstracted from the annual report of William H. Connell, chief engineer of the Philadelphia Bureau of Highways and Street Cleaning.

MAN ON MOVABLE BRIDGE FLOATS SURFACE

The construction was commenced on Oct. 5, 1914, and continued until Dec. 4, when, on account of cold weather, it was suspended until March 30, 1915. The concrete was completed on May 18, 1915, 66 working days being actually consumed on the work. The lateness of the season in which work was done was not conducive to the best results and is responsible, in a measure, for rather high costs. In all cases when the temperature was below freezing the road was covered with hay and canvas. The bituminous surfacing materials were applied between August and September.

The five principal sections were subdivided into two sections, each of which, 1050 ft. long, was left covered, while the remaining 1200 ft. was treated with four different bituminous wearing surfaces, the length of each of these treated portions being 300 ft. The materials employed for the wearing surfaces were Tarvia, Ugite, asphalt cut-back and Unionite. The cross-section of the road was uniform throughout the entire length, being 18 ft. in width and having a thickness of 7¼ in. at the center, 6½ in. at the quarter points and 5 in. at the sides, the bottom being a flat plane.

BUILT ON OLD MACADAM

The pavement was built on an old waterbound macadam roadway, which varied from 9 to 18 in. in depth and which was first spiked and then scarified, after which the macadam was removed to a depth of 5 in. below the finished grade. Then it was thoroughly rolled with a 10-ton roller.

The concrete used was composed of 1 part cement, 2 parts fine aggregate and 3 parts coarse aggregate. The aggregates varied in the different sections. In the first, Jersey gravel and whole pebbles were used; in the second, sand and trap rock passing a 1½-in. ring and retained on a ¼-in. screen; in the third, trap rock grit, and trap rock fulfilling the same requirements as in the second; in the fourth, trap rock grit and limestone of the same size requirements as in the case of the trap rock, and, in the fifth, sand and trap rock grit mixed in equal proportions and trap rock. The mixing was performed in a Ransome concrete mixer equipped with a charging device. The surface of the concrete was finished with a template cut to the cross-section of the road and then floated with wooden floats from a movable bridge built to span the concrete. Transverse joints were provided at intervals of 30 ft., and, with the exception of 10 joints which were laid at an angle of 30 deg., all were laid at right angles to the roadway. Two types were used: prepared bituminous joints and steel protected joints.

The prepared bituminous joints consisted of ¼-in. prepared felt, which extended through the entire thickness of the concrete. In order to secure straight joints, especially on the grades, and to facilitate the placing of the bituminous material, ¼-in. iron plates were placed across the road at each joint with the felt against it, and when the concrete was in place the joint was removed.

SUBSECTIONS GIVEN A BITUMINOUS SURFACE

The steel-protected joints consisted of plates 2½ in. in depth and ¼ in. thick, which were installed with a truss-Con holding device, which was removed as soon as the concrete was placed, ¼-in. prepared felt extending through the entire thickness of the concrete being used between the plates.

OLD MACADAM REMOVED TO DEPTH OF 5 INCHES BEFORE PLACING CONCRETE

WITH FEW EXCEPTIONS JOINTS WERE LAID AT RIGHT ANGLES TO ROADWAY

After sweeping the surface of the concrete thoroughly, 1/5 gal. per square yard of Tarvia B was applied with a pressure distributor. After this had thoroughly dried, ¼ gal. per square yard of Tarvia A was applied by the same means, at a temperature of 250 deg. and covered with a thin layer of ½-in. clean trap rock chips in the proportion of 10 lb. per square yard. Three days later a second coat of Tarvia A, ¼ gal. to the square yard, was applied with a pressure distributor, and covered with a thin layer of ½-in. trap rock chips in the proportion of 20 lb. to the square yard.

In the Ugite section, after sweeping the surface of the concrete, 1/10 to ⅛ gal. per square yard of Ugite A was applied with a pressure distributor, and, after two hours, covered with a thin layer of ½-in. clean trap rock chips in the same proportion as the first treatment on the Tarvia section. The following day, 1/3 to 3/10 gal. per square yard of Ugite 3 was applied at a temperature of 250 deg., also by a pressure distributor which, in turn, was covered with a thin layer of ½-in. clean trap rock chips, 20 lb. per square yard. The following day the second application of Ugite 3, of 1/3 to 3/10 gal. per square yard, was applied with a pressure distributor and covered with ½-in. trap rock chips in the same proportion. This application was rolled lightly with a 5-ton roller.

In the asphalt cut-back treatment a paint coat consisting of 50 per cent naphtha and 50 per cent of asphalt having a penetration of from 55 to 65, and in an amount of ⅛ gal. per square yard, was applied with a pressure distributor. Twenty-four hours later an application of 1/3 gal. per square yard of asphalt with a penetration of from 70 to 80, cut-back with from 35 to 40 per cent of naphtha, was applied with a pressure distributor. After two hours this was covered with a layer of trap rock chips graded from ⅛ to ½ in., 25 lb. being used to the square yard, and then thoroughly compacted with a 5-ton roller.

Unionite was applied on the day after the concrete surface had been thoroughly cleaned and a paint coat consisting of equal parts of asphalt with a penetration of from 58 to 65, and naphtha, in an amount of ⅛ gal. per square yard, had been applied. It was spread and rolled with a 10-ton roller, the thickness of the course being from ¼ to ⅜ in. after rolling. The Unionite consisted of specially prepared rock asphalt, ¼-in. crushed stone and Unionite asphaltic cement in the proportions of 47½ per cent rock asphalt, 2½ per cent asphaltic cement and 50 per cent stone, previously coated with asphaltic cement.

Treated Ties Save Growing Trees

Of the 3,000,000 crossties used every year by the Chicago, Burlington & Quincy Railroad for replacement purposes over 70 per cent are treated with a preservative. According to J. H. Waterman, superintendent of the railroad's wood-preserving plant at Galesburg, Ill., the millions of treated ties in their tracks now last from twelve to twenty years, whereas untreated they last on an average of eight years. In each of the twenty divisions of the Burlington system there are tracks for experimental purposes containing 26,000 treated ties of different species, which are all carefully inspected at least once a year for the actual results of treatment as shown by the service test.

Literature

For the Civil Engineer and Contractor

Books Reviewed

Irrigation Practice and Engineering—Vol. 3

Author, B. A. Etcheverry, head of department of irrigation, University of California. Cloth, 6 x 9 in.; 438 pages; 186 illustrations. New York, McGraw-Hill Book Company, Inc. $4 net.

REVIEWED BY F. H. NEWELL

Head of Civil Engineering Department, University of Illinois, Urbana.

The third volume of this work fulfills the promise of the two preceding books and rounds out a series of much interest and value, not merely to the engineer but to investors and others concerned in irrigation development. In this, the last of the series, Professor Etcheverry takes up irrigation structures, including not only those in general use, but also many especially devised or found necessary under different conditions of topography and climate. This is probably the most complete and suggestive collection of details of such works which is to be found in any one place.

The preceding volumes are devoted to fundamental principles and problems, while the one under consideration deals with such topics as diversion works, scouring sluices, main headgates, spillways, road crossings and measuring devices. The last named are of particular interest, as modern development is largely along the line of securing greater economy in the use of water. This can be accomplished only through more complete records than those of the past, giving the amount of water entering the canal, flowing in its principal branches and delivered to each of the hundreds of thousands of users taking water from the system.

The book is notable for the variety of the illustrations and the concise, yet clear, description of the larger facts worthy of the attention of the engineer.

Web of Steel

A novel by Cyrus Townsend Brady, and Cyrus Townsend Brady, Jr. Cloth, 336 pages, illustrated. New York, Fleming H. Revell Company; $1.35 net.

In "Web of Steel" the authors have selected the design and sudden failure of a great international bridge as the main incident of a tale in which engineering is blended with romance. While the Bradys disclaim any attempt to portray actual events, the engineer will recognize in the situation with which the book deals unmistakable resemblances to certain phases of the failure of the Quebec Bridge nine years ago. The story centers about a young engineer who, while assisting his father, a man of prominence in the profession, in the design of the great steel structure, becomes engaged to the daughter of the president of the company which is erecting the bridge. When partially completed the structure falls into the river. The young designing engineer, while in no way responsible, assumes the blame for the accident to protect his father's reputation and disappears, leaving his girl behind. She finds him, after a long quest, on a Western irrigation project after he has all but lost his life in a heroic effort to save a dam from being washed out during a flood.

The first eight chapters of the novel are tedious reading, but after the authors reach the dramatic incident of the bridge failure and the consequences the story moves rapidly and holds the reader's interest to the end.

Letters to the Editor

Comment on matters of interest to engineers and contractors will be welcomed

Architect vs. Engineer

SIR: Your timely and able article on page 406 of the March 25 issue is of great importance and will doubtless do much good. It meets my hearty approval and points the proper way to a broader and better policy than can possibly obtain through any license scheme no matter how complete in detail or thoroughly applied.

No form of legalized trade unionism can be made of general public interest though it may be made to serve a measure of limited private interest very well at public expense. Its mischievous tendencies are of a subtle, vicious nature, apt to invite all sorts of dangerous political complications and corrupt the whole body politic.

A broad democracy and free country can never thrive under the burdens of a complete license system. No able architect or engineer wants it and no others should be given such a dangerous political plaything.

WM. RUSSELL SMITH.

York, Pa.

SIR: I was much interested in your editorial in your issue of March 25 on "Architect vs. Engineer." I am convinced, however, that the author of this editorial, in common with most engineers, views the alleged controversy between architects and engineers from the wrong standpoint.

There is no conflict between the two professions, nor can there be as such. Architecture is building and even one with the most rudimentary knowledge of the English language knows that when an engineer, or for that matter, a doctor or a lawyer, designs and supervises the construction of a building, he is practicing architecture. The mere fact that he may style himself an engineer or otherwise than as an architect has no bearing on the case.

In my humble opinion, the entire controversy is caused by the common misuse of the terms. Each and every building is a piece of architecture and may and usually does embody the work of many sciences and arts. The structural framework of the building, its foundation and its ventilation plant are as much architectural features of the building as are the colors of the frieze, the outline of its cornice or the colors of the pigments used. Many engineers contend that certain classes of commercial buildings should be in charge of engineers. I have no quarrel with them except that I maintain when they are designing buildings they are practicing architecture. The man who plans is the architect, no matter what he calls himself.

I am willing to grant you this controversy between architects and engineers in the states where architecture is controlled by law is caused by the fact that in such states no one can style himself an architect unless he qualifies under the law as an architect. In states where there is no legal restriction to the use of the title, whoever heard of any man, whether engineer or contractor, who specialized in the construction of buildings who styled himself anything but an architect. The term architect has always been and, without doubt, always will be, used to designate the men specializing in the design and supervising of the construction of buildings. Building engineering is a part of architecture; therefore, how can we separate laws pertaining to architectural engineering from laws pertaining to the other elements which go to make up architecture?

Personally, as an academic condition, I do not agree with your contention that all laws regulating both architects and engineers should be wiped off our statute books. Nor do I believe that you would go so far as to argue that all laws regulating the professions of law and medicine, pharmacy, dentistry, etc., should be wiped off the statute books. In Illinois, at least, I believe the universal opinion of those qualified to judge is that the working of the architects' law during the last 19 years has resulted in improving very materially the professional standing of the profession of architecture. The quality of the work turned out by the profession is pronounced by able judges to be far superior to that turned out in communities where anyone may style himself an architect without any restriction whatsoever.

I am convinced that if you will correspond with the leading members of the engineering profession who have specialized in building work, you will find that a very large majority will agree with the writer's contention. I think you will also find that it is only those engineers who are not qualified by education and training to pass the elementary examinations conducted by the various state boards of examiners of architects, who are insisting that the engineers should be given equal rights with the architectural profession to design and supervise buildings, overlooking absolutely the legal and lexographers' definition of terms, which would style him an architect whenever he so acts.

Chicago, Ill. A Chicago Engineer.

Do Wooden Piles Fail?

Sir: The conclusion of Robert J. Reidpath & Son, in the Engineering Record of March 18, that piles and wood in other form, when buried in the ground and protected from air, do not decay, is undoubtedly correct. Much depends, however, on the character of the ground. A light, sandy soil, for example, is probably less of a protection than heavy clay or loam. This has been noticed in the case of telegraph poles, those set in cinder ballast being decayed to a greater depth below the ground line than those in heavier foundations. Since the agents of decay in wood are living vegetable organisms known as fungi, and as these require air, moisture, moderate temperatures and food in order to develop, it follows that the cutting off of the air supply would prevent the growth of decay organisms.

Supplementing the observations of Mr. Reidpath, it is reported that old Fort Marion in St. Augustine, Fla., was built on a pile foundation, and as this building was erected in the seventeenth century and no failure due to subsidence of foundation has been noted, it is obvious that the piles must have remained sound, since the subsoil is not of stable character.

It is, of course, well known by engineers that creosoted piles should be used where exposed for part of their length to air or water, and that timber properly creosoted will resist decay almost indefinitely, even at the ground line, or in teredo infested waters. As evidence of this are recent reports on timber piles in the coal docks of the Lehigh Valley Railroad at Perth Ambody, N. J., that are still sound after 30 years' service, and marine piling in the Gulf of Mexico which has given 40 years' service.

E. A. Sterling,
Manager National Lumber Manufacturers' Association.
Chicago, Ill.

What Is an Engineer?

Sir: Educators are proverbially conservative and cling to those educational instruments that appear in the past to have been effective in developing men, not only in mind, but in character. It appears to me that this spirit of conservatism, although it may be a blind following of tradition, is a saving grace rather than a fault in these times, when so many persons would like to try experiments on our young people.

Many of our colleges are attempting to overcome a dissipation of the mental energy of our younger generation, and to confine their energies to disciplinary studies that produce mental staying power, and a power of organized thought. Of course, this process is fundamental to the pursuit of any professional career.

Personally I think that our modern technical education is as good an instrument for this particular training as the old education in the humanities.

I appreciate the fact that our modern technical education lacks the mental stimulation that came from the old education wherein the pupil re-thought the thoughts of the great intellectual leaders of the world. What is there in modern technical education to replace the ancient classics with their inspiration, with their discipline in the accuracy required in composition? Where in laboratory work and testing materials and the study of mechanics will we find intellectual food to replace the reading of Republic of Plato? Where is the equivalent for the breadth of view that the student of history obtained from Gibbon? Has any educational instrument of recent times replaced the study of formal logic?

And yet our modern technical education does produce effective workers and useful citizens, and I hope that I shall never be as pessimistic about the results as my honored colleague, Professor Swain.

It is, of course, disheartening to find that our seniors in technical colleges as a rule have but little intellectual life. But, after all, they have been passing through the grammar of engineering. It is just as if a student in a classical college should not pass beyond grammar and composition. Some inspirational courses covering the lives of the engineers and describing the complete circumstances of some great work of engineering, should be given. Many a student who has dropped engineering courses at the end of the sophomore year on account of lack of interest, and afterward takes a position in the field, realizes the fascination of the work of the engineer.

With respect to the results of the inquiry announced by Professor Mann: I am sure that college students will be glad to hear the good news that the things they take delight in, namely, the pursuance of general college activities, what President Wilson called "the side shows," have a value of 75 per cent, whereas in the things that they don't care to do and which the professors are spending the greater part of their effort to force them to do, there is a value of only 13 per cent. These results of Professor Mann's inquiry seems to me from the standpoint of practical college administration to be fantastical.

Every one knows that the study of mathematics not only gives proficiency in algebraic transformation and trains the mind to the logic of a mathematical process, but it produces character as does any hard task, faithfully pursued.

I am enclosing a form of estimate cards which we have used for a good many years in Purdue University to determine the personal qualities of our students.

W. K. Hatt,
Professor of Civil Engineering, Purdue University.

Name .... Class ....
Age at graduation .... Elective ....
Honors ....

Qualified for 1 2 3	Teaching........	Drafting..........	Designing..........
Preference a b c	Selling..........	Journalism........	Fieldwork..........
	....		

Peculiarities or Physical Defects ....
....

DEPARTMENT ESTIMATE

A—Good B—Fair C—Poor

Habits..............	Popularity...........	Address	Mental Caliber..........
Industry............	Accuracy............	Speed..............	Self Reliance..........
Reliability..........	Originality...........	Drafting...........	

Best known by ....
Remarks ....

HINTS FOR THE CONTRACTOR

Details Which Save Time and Labor on Construction Work

Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents

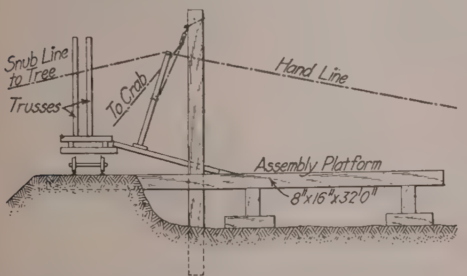
[*Contributions to this section are solicited, and if found available will be paid for. They must be* SHORT, *and should be accompanied, if possible, by photographs or sketches.*—EDITOR.]

Skidding Bridge Trusses in Vertical Position Off Flat Cars

By W. G. MILLER
Indianapolis, Ind.

SIX BRIDGE trusses each 63 ft. long were recently unloaded by the writer from flat cars without any of the usual hoisting equipment, spread apart on a platform at the side of the main line, assembled with their floor beams, etc., and moved into place to form part of a bridge over the Big Raccoon River on the Central Indiana Railway near Bridgeton. The three spans to which these trusses belonged had formerly been part of a six-span bridge on the Big Four Railroad, which had been taken down and stored at the Beech Grove shops of that railroad. The trusses were loaded in two sets on four cars with three trusses side by side on two flat cars. The other material for the three spans was loaded on two gondola cars, the entire loading time being a day and a half.

The only tools used in unloading the trusses were two crabs, ten screw jacks and the necessary tackle and timbers. There was one train each way during the day, and the unloading was arranged not to interfere with them. There was a fill of about 5 ft. at the point where the material was unloaded. A platform made of six stringers spaced about 10 ft. apart was built level with the track, being blocked up from the ground. Ties were removed from the track and the ends of the stringers passed under the rails. Two stringers were set up, one at each end of this platform, as gin poles in the location shown in the accompanying sketch. They were erected far enough apart to allow the trusses to pass between them. The cars carrying the first load of trusses were then spotted and skids placed from the car floors to the platform and blocked. The two crabs were then chained down to the track, one at each end of the railway cars. A line from each crab led over a block at the top of each gin pole. These lines were tied to two chain hitches, one at each end of the first truss to be unloaded. Snub lines of 2-in. manila rope were tied to the top of the truss and paid out around trees on the opposite side of the track. A small piece of oak was set under each end of the truss to form a sliding surface on the skids.



TRUSSES UNLOADED "STANDING UP" WITH SIMPLE HOISTING EQUIPMENT

The truss was jacked off the car to the skids and tilted over till it made a right angle with the skids. The ropes on the crabs and the snub lines were slacked off as the bottom of the girder was pinched along the skids with bars. Hand lines on the side of the truss next the platform were also used to help slide it along.

Each of the remaining five trusses was unloaded in the same way. The stringers, bracing and other material was taken out of the gondola cars with the aid of the gin poles and crabs. Each span in turn was assembled and riveted on the platform, jacked over on to the track and pulled out to place by a locomotive. The new bridge replaced a pile trestle containing one 90-ft. girder span, which had made trouble in previous floods by catching drift. The work was carried out by the writer as superintendent of construction.

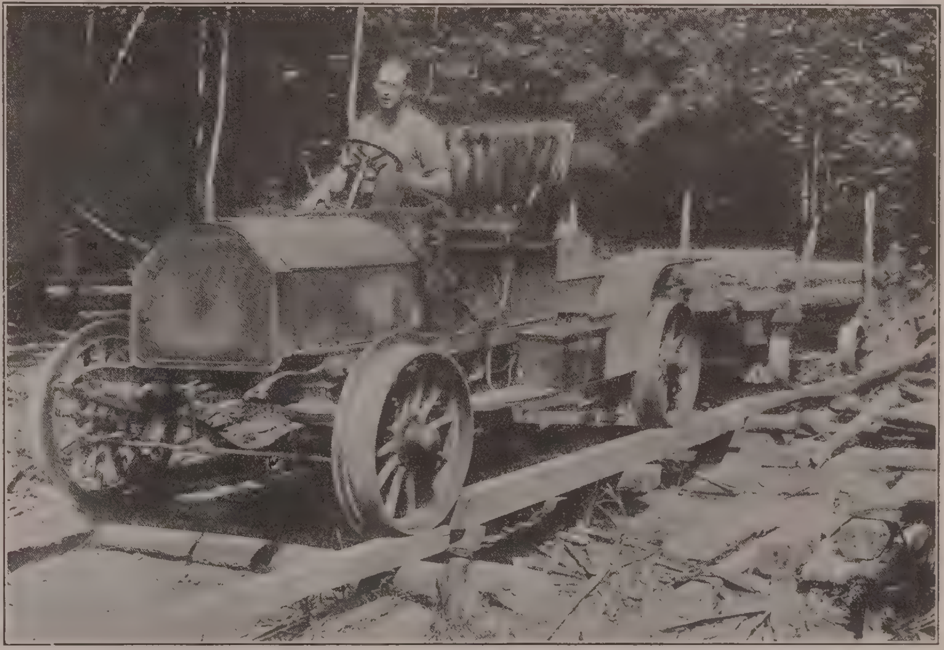
Cut Vent Holes and Fill Settles to Firm Foundation

AT VARIOUS points the Coleman-du Pont concrete road, in Delaware, was constructed over swamps. Ordinarily these were drained before the fill was deposited, but in one case the cost would have been prohibitive so the fill was made directly on the surface of the swamp, which floated on several feet of black muck. Below this was a solid foundation of sand and bog ore. It was thought that the weight of the embankment would carry it down to this stratum, but it did not. The difficulty was surmounted by cutting holes through the swamp surface near the toe of the fill. The muck was forced up through these and the solid earth settled down to the firm foundation.

Loads of Lumber Transported by Automobile Without Building Road

By GEORGE W. RICHARDS
Cleveland, Ohio

A READILY-LAID track of 4 x 4-in. maple rails laid on tree-trunk ties has been used recently in Massachusetts to secure transportation at automobile speed from a portable sawmill operating in the woods to the nearest county road, a distance of 2 miles or more. A second-hand 35-hp. automobile with flanged cast-iron rims placed on its wheels was used to draw a platform car on which the lumber was loaded. The line had a maximum grade of about 7 per cent. The ties were obtained when the line was cleared, and were laid directly on the ground, being blocked up only where absolutely necessary. One man by spending about a day's time a week was able to keep the line in good condition. There was a turntable at each end of the line so that the car was always pulled. The outfit did the work of three two-horse teams.



MUCH CHEAPER THAN ROAD-BUILDING, TRACK ENABLED AUTO TO REPLACE THREE TRUCKS

Motor Trucks Operated on Long Hauls Over Bad Roads in West

By GEORGE F. YOUNG
Bend, Ore.

TRAVELING over what would be considered in the East bad roads, with 3 to 4-ton loads of through freight, automobile trucks are being operated in this district on long hauls under conditions similar to those affecting road transportation to remote construction work at a cost of 41 cents per mile. The costs which are given in the accompanying table are for operating a regular freight and express line, but practically all of them except office expense and the items for rebates, bad accounts, etc., would be the same in hauling for construction work.

Items	Total cost	Cost per mile
Road expense	$1,086.28	$0.0383
Wages of drivers	2,335.41	0.0823
Office expense	165.91	0.0058
Miscellaneous	202.81	0.0071
Interest	240.00	0.0080
Depreciation (2 trucks allowing 5-year life)	1,600.00	0.0564
Tire cost	1,812.47	0.0642
Cylinder oil	278.06	0.0098
Other oil and grease	38.12	0.0013
Gasoline	2,050.64	0.0723
Maintenance (new parts)	1,327.54	0.0468
Repairs in garages	175.73	0.0052
Supplies, hardware, etc.	138.59	0.0049
Rebates, bad accounts, etc.	304,61	0.0107
Total operating cost	$11,756.17	$0.4131

These figures are for a 300-mile round trip haul over rough country roads where no particular road work had ever been done aside from clearing away the brush and rocks. The roads were used for freighting with narrow-tired wagons and the ruts were very bad. A total of 716,592 lb. of freight were handled during the time for which these costs are given, nearly all of it traveling in one direction. The two 3-ton trucks made altogether in this time a little more than 28,000 miles. The average loaded speed was not more than 6 or 8 miles an hour, and the roads would not permit running the trucks light at more than 12 miles per hour. Hauling was continued throughout the winter in heavy snow, and throughout wet weather in heavy soil. There were numerous steep grades, and one end of the road was mostly sand and volcanic ash which made bad going in dry weather. Gasoline cost from 26 to 28 cents, and the drivers were paid at the rate of $100 per month. It is thought that because the trucks had double rear drive wheels, throwing all the load in running over the rutted parts of the road on the outside tires, that the tire expense was much greater than would have been the case with a single wheel of the same gage as the ordinary wagon tire.

TWO TEN-INCH GAS MAINS EACH WELDED INTO ONE PIECE WERE LOWERED TO PLACE TO SAVE WORKING TIME OVER TREACHEROUS TEXAS RIVER

Although the trucks were rated at 3 tons capacity, they were rarely loaded with less than 6500 lb. of freight in addition to gasoline and oil for the round trip. The writer has no costs on team hauling through this country, but the freighters formerly asked $30 a ton for this and shorter hauls, and none of them made any fortunes.

Another firm operating one 3-ton truck and one 1½-ton truck through this country finds actual operating expenses, without allowing for depreciation, to be 30 cents per mile.

Gas Mains Across Brazos River Welded and Lowered in One Piece

By C. R. SUTTON
Indianapolis, Ind.

TO SAVE pumping out a trench in quicksand and also to reduce the length of time falsework would have to be maintained across a very treacherous river, two 10-in. gas mains were recently laid at Waco, Tex., by welding each into a complete section extending clean across the river and lowering the sections with tackle. A trench to accommodate the gas mains and also twelve submarine cables was sheeted and excavated about 14 ft. below the river bottom into a bed of gravel. The sheeting was anchored with rods to piles driven above and below it, and no braces were set across the trench. This work was done by a traveler derrick run on falsework above the trench. As the river is subject to destructive rises all through the year, the 20-ft. lengths of pipe were first welded into 100-ft. sections so that the lines could be connected up and lowered with the least possible handling over the water.

The oxy-acetylene welding process was employed, using Norway iron welding wire as a filler and making a butt weld with plain pipe ends. It took about 45 min. to make each joint in this way, though it is thought that with the beveled-end pipe now manufactured joint welds can be made in two-thirds of this time. Prest-O-Lite dissolved in acetylene was used as a fuel in the welding process. The drip pockets, one of which is shown in one of the photographs, were made by welding sections of boiler plate together and to the pipe.

As several pipe lengths, extending above water, were welded to each end of each line before lowering, the lines had to be weighted to sink them to the bottom of the trench. This was done by attaching pieces of scrap steel sheet piling, also cut up with the torches. The work was in charge of the Phoenix Construction Company and was carried out under the direction of their engineer, B. Diem.

Back Dump Motor Truck Best for Asphalt Repairs

THE BACK dump motor truck has been found the best adapted to distributing the materials for asphalt paving repairs by John P. Binzen, engineer of maintenance, highways and sewers, of the Borough of the Bronx, New York City. Power from the motor is used to elevate the body, and at the proper elevation the material can be pulled out by a raker without the necessity of having a shoveler on the truck. The raker quickly learns to gage the quantity that is needed, so there is very little waste.

Heavy Snowfall for March

Only once in the last 20 years has the snowfall for March in New York exceeded the total of 25.5 in., recorded last month by the local Weather Bureau. The New York record for March, 28.5 in., was established in 1896. The cost of this season's snow-removal work in New York, it is estimated, will be nearly $2,000,000. The average temperature for March and February of this year has been 27.5 deg. For both months the snowfall has aggregated 36.6 in.

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

Will Call for Bids for Immediate Reconstruction of Burned City

Destruction of Paris, Tex., Affords Ideal Opportunity for Modern City Planning Involving Expenditure of Over $400,000

Following the almost complete destruction of Paris, Tex., by fire, noted in recent issues of this journal, the officials of that city have been actively engaged in remodeling the old plans and laying out parks, roads and fire districts in such a way as to greatly increase the city's attractiveness. W. H. Dunn, city planner and landscape architect, has been retained to prepare plans and under his direction the main thoroughfares will be made 80 ft. wide instead of 60 ft. as before, and all other streets will have a minimum width of 50 ft. as compared to the old 40 ft. plan.

About four miles of new streets will be opened up; the square will be parked and a new site between Nineteenth and Twentieth and Sherman Streets for a market square has been purchased by the city for $26,000.

Two plans have been suggested for the new civic center, one being to rebuild the court house and city hall on blocks 10 and 19 respectively, park the two intermediate blocks 11 and 12 and build a permanent road due northeast from the center to an existing road outside the city. The second plan suggests building the city hall on block 15, parking blocks 5 and 180 and erecting a public library, or some similar structure, at the north end.

Building lines are being set for all types of buildings in every part of the city and the state fire insurance commission code has been adopted. Every building within the fire limits will be required to be practically fireproof, and special importance will be laid on the desirability of non-combustible roofs.

A considerable amount of paving was badly damaged by the fire and will have to be relaid and extensive areas of wood block paving were badly burned. About 2000 yd. of new wood block paving will be laid beside that necessary to repave the damaged part.

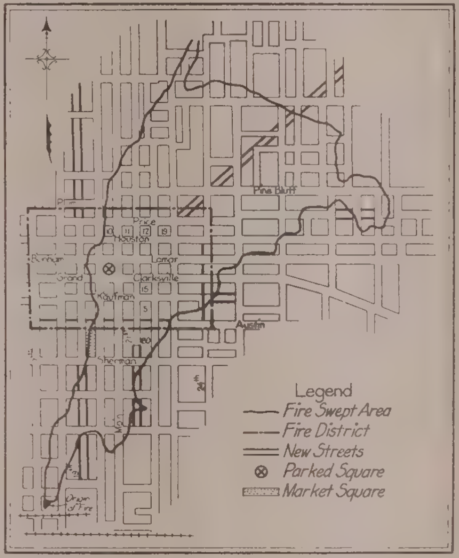
Bonds of amounts named have been voted for the following purposes: $10,000 for city comfort station, $10,000 for remodeling present sewage disposal plant, $50,000 added to present funds for construction of school houses. R. G. Taylor is city engineer.

The government has appropriated $200,000 for the construction of a new post office building, plans for which are being made at Washington, D. C. A new court house will be erected at an approximate cost of $150,000, under the supervision of Sam Bedford, county auditor. Bids on this work will be called for about May 10.

New York Subway Strike Settled —Union Recognized

An agreement between New York subway contractors and the International Tunnel & Subway Constructors Union of America, entered into April 18, has settled the strike called recently on the New York subway construction work and will, it is hoped, prevent the occurrence of any future strike while the new system is being finished.

The agreement was signed by a committee representing all of the contractors involved and by the president of the United Portable & Hoisting Engineers, who went out on a sympathetic strike, in addition to the representatives of the new union. It does not affect the compressed air workers, who had gone out on a strike of their own while negotiations were pending, but it was expected that most of the subway work would be reopened on full time beginning with April 19. The wage increases agreed to by the men, which were considerably lower than those asked for in the beginning, are: Laborers, $2 for 8 hr.; timber men, $2.75 for 8 hr.; timber men's helpers, $2.20 for 8 hr.; concrete machine runners, except where engineers have jurisdiction, $2.50 for 8 hr.; wood form makers, $2.75 for 8 hr.



SHOWING HOW PARIS, TEX., WILL BE REMODELED

Propose New Road to Divert Traffic from Two Crossings

To divert traffic simultaneously from two grade crossings at Montgomery, Ala., where the same road crosses the railroad twice, the Seaboard Air Line Railway has made the city an offer to build at its own expense a connecting road 4500 ft. long, at an estimated cost of upward of $50,000. The road is the lower Wetumpka Road, which carries a heavy traffic. One of the crossings is over the throat of a yard, and several accidents have occurred there in the last two years. The new road would not eliminate the crossings; this would be difficult because the old road is built up almost solidly for half a mile. The new route would be shorter, however, and would presumably take most of the through traffic.

Plans are now being prepared in the office of the division engineer at Savannah, Ga. The proposal of the railroad includes the offer of a fixed sum to the city for maintenance.

Nitrate Plant Amendment to Army Bill Passes U. S. Senate

The amendment to the Chamberlain army bill appropriating $15,000,000 for a government hydroelectric plant to produce nitrates for fertilizers and making explosives passed the Senate April 14, by a vote of 43 to 22.

The action came as the result of an amendment by Senator Smith, of South Carolina, which provides for the sale of Panama Canal bonds to raise the necessary $15,000,000. The amendment, as noted in the issue of the Engineering Record of April 8, authorizes the President to make available not more than five water power sites for the construction of nitrate plants.

Engineers Selected For Nation-Wide Inventory of Industrial Resources

Naval Consulting Board's Preparedness Committee Chosen from Members of Five Professions in Every State

Selected from the membership of the five national engineering societies—civil, mechanical, electrical, mining and chemical—the names of the engineers who will conduct a census of the nation's industrial resources, in co-operation with the Naval Consulting Board, were made public this week. Five men have been chosen from each state, one from each of the five professions, and they will work under the general direction of Howard E. Coffin, chairman of the committee, and W. S. Gifford, chief statistician of the American Telephone & Telegraph Company, who is acting as supervising director of the survey.

In making public the names of the committee members, Mr. Coffin said: "The names and standing of these men speak for themselves. They have been selected by their own professional associates and the only standard has been that of efficiency and integrity. They work without pay—indeed, the services of many of them could not be bought. In my judgment they form a vast, flexible organization, the like of which has not been known in this or any other country—an organization, moreover, which is, from top to bottom, absolutely non-partisan and non-political."

Members of Committee

The names of the civil engineer members of the committee, by states, follow:

Alabama—J. S. Sewell, Alabama Marble Company, Gantt's Quarry.

Alaska—R. J. Wulzen, Alaska Gold Mines Company, Thane.

Arizona—J. B. Girand, consulting engineer, Phoenix.

Arkansas—Charles H. Miller, president, Miller Engineering Company, Little Rock.

California—Wynn Meredith, engineer with Sanderson & Porter, San Francisco.

Colorado—H. S. Crocker, consulting engineer, Denver.

Connecticut—H. R. Buck, of Ford, Buck & Sheldon, Inc., Hartford.

Delaware—Andrew Bryson, Brylgon Steel Casting Company, New Castle.

District of Columbia—C. B. Hunt, engineer of highways, Washington.

Florida—L. R. McLain, president, Florida Engineering Company, St. Augustine.

Georgia—G. R. Solomon, Solomon-Norcross Company, Atlanta.

Idaho—M. S. Parker, St. Maries.

Illinois—R. W. Hunt, president R. W. Hunt & Company, Chicago.

Indiana—William K. Hatt, professor of civil engineering, Purdue University, Lafayette.

Iowa—George H. Boynton, president, Northern Gravel Company, Muscatine.

Kansas—D. H. Whitmer, Whitmer Contracting Company, Pittsburgh.

Kentucky—Richard Montfort, consulting engineer, L. & N. R. R., Louisville.

Louisiana—Arsene Parelliat, engineer, Hercules Company, Ltd., New Orleans.

Maine—E. C. Jordan, consulting engineer, Portland.

Maryland—H. D. Bush, Carnegie Steel Company, Baltimore.

Massachusetts—Fayette S. Curtis, president, Old Colony Railroad Company, Boston.

Michigan—Gardner S. Williams, consulting engineer, Ann Arbor.

Minnesota—William L. Darling, chief engineer, Northern Pacific Railway, St. Paul.

Mississippi—M. L. Lynch, Jackson.

Missouri—Daniel Bontecou, consulting engineer, Kansas City.

Montana—Eugene Carroll, vice-president and manager, Butte Water Company, Butte.

Nebraska—Elliot Holbrook, special engineer, Southern Pacific Company, Omaha.

Nevada—W. T. Gould, Nevada-California-Oregon Railway, Reno.

New Hampshire—Robert Fletcher, director, Thayer School of Civil Engineering, Dartmouth College, Hanover.

New Jersey—Morris R. Sherrerd, chief engineer, Board of Street and Water Commissioners, Newark.

New Mexico—O. H. B. Turner, chief engineer, St. Louis, Rocky Mountain & Pacific Company, Raton.

New York—J. G. White, president, J. G. White & Company, Inc., New York.

North Carolina—J. L. Ludlow, consulting engineer, Winston-Salem.

North Dakota—T. R. Atkinson, consulting engineer, Bismarck.

Ohio—Chester W. Larner, hydraulic engineer, Wellman - Seaver - Morgan Company, Cleveland.

Oklahoma—H. V. Hinckley, consulting engineer, Oklahoma City.

Oregon—George C. Mason, vice-president, Hurley-Mason Company, Portland.

Pennsylvania—George S. Davison, president, Gulf Refining Company, Pittsburgh.

Rhode Island—John W. Ellis, consulting engineer, Providence.

South Carolina—John McNeal, consulting engineer, Columbia.

South Dakota—Bruce C. Yates, assistant chief engineer, Homestake Mining Company, Lead.

Tennessee—William W. Carson, professor of civil engineering, University of Tennessee, Knoxville.

Texas—John B. Hawley, consulting engineer, Fort Worth.

Utah—A. F. Parker, Ogden.

Vermont—Frank O. Sinclair, consulting engineer, Public Service Commission, Burlington.

Virginia—E. T. D. Myers, Jr., consulting engineer, Richmond.

Washington—A. O. Powell, consulting engineer, Seattle.

West Virginia—A. M. Scott, Charleston.

Wisconsin—D. W. Mead, consulting engineer, Madison.

Wyoming—Edward Gillette, Sheridan.

$750,000 Municipal Bonds Voted in New Mexico Cities

Recent bond elections in cities of New Mexico have resulted in contemplated expenditure of over $750,000 on city improvements. Albuquerque will issue $400,000 worth of bonds to purchase waterworks and $300,000 will be spent by the city of Alamogordo for water, light and ditch improvements. Springer has voted $37,000 for improvements on waterworks, while Las Cruces will spend $19,000 for waterworks and sewers.

Bond issues of $50,000 each for waterworks and improvements were defeated in Gollup and Cimarron.

$45,000,000 to Avert Floods

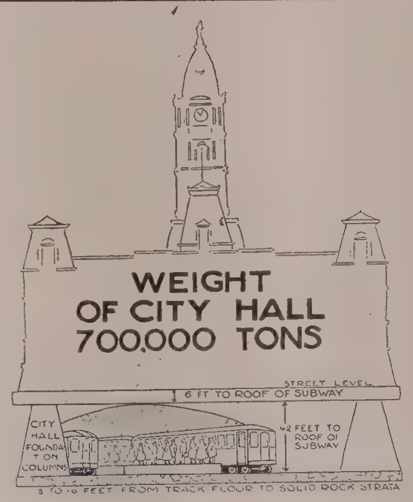
A bill authorizing the expenditure of $45,000,000 for the prevention and control of floods on the Mississippi River and $5,600,000 for the Sacramento River was reported to the House of Representatives, April 18, by the committee which has been investigating the problem for weeks.

The measure provides that not more than $9,000,000 shall be expended on the Mississippi in any one year and that not more than $1,000,000 shall be spent on the Sacramento. The appropriation of the Federal Government for the latter project is also made contingent on the expenditure of an equal amount by the state of California.

New York Engineers Organize for Further Military Training

Open-Air Drills, Week-End Encampments and Target Practice in Armory Ranges Planned—To March as Body in Preparedness Parade

Four hundred New York engineers of those who attended the military lecture course organized by the Military Engineering Lectures Committee, who have since been drilling in six companies under the instruction of officers of the New York National Guard, have formed an executive committee to enlarge the scope of the training and to co-operate with the lectures committee so as to relieve it of the detailed work necessary to this end. The new committee consists of: R. S. Buck, engineer of maintenance-of-way, New York Railways Company, temporary chairman; C. R. Hulsart, assistant engineer, Board of Water Supply, temporary secretary; Major W. H. Roberts, Board of Estimate, temporary treasurer; and A. S. Dwight, mining engineer; D. A. Sealey, assistant to Robert Ridgway, Public Service Commission; A. Maxwell, engineer of tests, New York Edison Company; K. G. Martin, Mergenthaler Linotype Company; and H. D. Hammond, associate editor, Engineering Record. This committee will arrange for rifle practice at the Twenty-second and Seventy-first Regiment Armories, and for Saturday and Sunday extended-order drills and field work at Van Cortlandt Park and Governor's Island, in addition to the work now being done at these armories on Tuesday and Thursday evenings. It is expected that, when the men become more proficient in fundamentals, blackboard lectures on military tactics will be added.


WEIGHT OF CITY HALL 700,000 TONS
STREET LEVEL
6 FT TO ROOF OF SUBWAY
CITY HALL FOUNDAT ON COLUMNS
42 FEET TO ROOF OF SUBWAY
8 TO 16 FEET FROM TRACK FLOOR TO SOLID ROCK STRATA

THE NEWSPAPER ARTIST DREAMS

The illustration, which appeared in a recent issue of a Philadelphia newspaper, is explained by that journal in the following caption:

"So that the reader may have illustrated plainly just how City Hall is affected by the proposed tube and station under the hall, the artist has drawn from the description of the engineers the above illustration. It will be noted that the approximate weight of City Hall building is 700,000 tons, which rests upon foundations laid on the solid rock formations found at a depth of 48 to 64 feet below the street level. The tube rests upon its own columns, which are laid on the same solid rock foundation. There is a skin of earth between the street level and the tube roof which approximates six feet. From the track floor of the tube, to the ceiling of the subway, there is 42 feet allowed for overhead work, which includes, of course, the crust of concrete which constitutes the roof of the tube. Examination has shown that the City Hall foundations are crumbling and that the shoring and underpinning provided to support them can be accomplished only with great difficulty, according to the report of the Mayor's commission. It is this extra work which will increase the cost of construction of the City Hall station. This increase is estimated unofficially at 100 per cent over the $1,700,000 contract price."

Engineers will be surprised to hear that a 700,000 ton building can be supported by a beam of earth 6 ft. deep and of 300 or 400 ft. span. The artist may have "drawn" from something beside the engineers' description.

An immediate work of the committee will be a card index in military form giving the usual records, and also the special professional qualifications, of each man, to assist the War Department in assigning the men should an engineer reserve be organized or should a sudden necessity arise. The organization will take part as a body in the engineers' parade in favor of military preparedness, May 13.

It is the intention of the committee to furnish, with the assistance of the officers of the regular army and of the National Guard, all the immediate facilities for military instruction that can be arranged without interfering with the business duties of the members of the battalion. Later these men can complete their training by qualifying for an engineer reserve, if one is organized, by attending the Plattsburg camps or by joining individually organizations of the National Guard. Recruits to the battalion will be welcome, according to the committee.

Illinois Directors for Industrial Preparedness Raise Funds

A fund of $25,000 is to be raised to cover the expenses of the Illinois state directors of the organization for industrial preparedness and associate members of the Naval Consulting Board. The directors met in the rooms of the Western Society of Engineers, Chicago, and elected F. K. Copeland, chairman, and William Hoskins, secretary, representing the mining engineers and chemists, respectively. The other directors are Capt. Robert W. Hunt for the civil engineers, Dr. W. F. M. Goss for the mechanical engineers and P. Junkersfeld for the electrical engineers.

To meet the immediate requirements of the board, the nucleus of a fund was made by Captain Hunt, acting in his individual capacity, contributing $500, Mr. Copeland, on behalf of the Sullivan Machinery Company, contributed $500, and Mr. Junkersfeld, on behalf of the Commonwealth Edison Company, $500.

Local societies, whose services the chairman may feel would be helpful to the work of the board, will be asked to appoint committees for consultation and co-operation.

Texas Takes Steps Toward Correct Sewer Construction

As a result of the passage of the Anti-Stream Pollution Act by a recent session of the Texas Legislature, 425 cities are forced to change their sewer systems. Of this number, 130 have sewerage systems at this time, and the majority are taking steps toward complying with the law. V. M. Ehlers, state sanitary engineer, recently made an investigation and his report shows that additions to sewer systems will be necessary in 22 towns.

Another interesting development is that engineers designing sewer systems or improvements for towns and cities in Texas will not secure approval of their plans unless they show all possible extensions to the sewer, whether then contemplated or not. This step has been found necessary by the state sanitary engineering department in order to protect cities and towns from a complete reorganization of sewer systems when extensions are made or from the installation of pumping plants necessitated by failure to provide proper levels for gravity flow.

Idaho Road Work Is Started

R. T. Hassard, assistant state highway engineer, at Boise, Idaho, has completed arrangements for immediate commencement of work on the Salmon River road, known as the North and South Road, which is to be part of the highway extending from Mexico to Portland. The work, which, it is expected, will take three years to complete, will be done by convict labor and about 40 prisoners have already been put to work.

Fire at Nashville, Tenn., Does Over $1,500,000 Damage to Buildings

The fire which recently destroyed Nashville, Tenn., originated in a collection of frame shanties on the outskirts of the city, was whipped into a terrific conflagration by a 50-mile-an-hour wind and did $1,500,000 worth of damage before it smoldered out. The flames made a clean sweep of buildings, trees, fences and all other combustible material and even the ground in the path of the fire was burned to a brick red.

The rapidity with which the fire spread can be easily imagined when one case is cited. A twelve-room two-story frame house, the roof of which was of good tin, seemed to burst into flame spontaneously and in 14 minutes it was completely destroyed.

Many of the buildings were of good brick construction, and had slate roofs and all interior walls and partitions of brick. Wood was used only for floors, joists, trim, roof trusses and window frames. This type of building did not even act as a retardent. Lime-stone steps, foundations and trim were almost calcined, while Portland cement steps, porches and plastered surfaces were less damaged.

The fire has made it much easier to fix and enforce stringent construction rules and make large areas where all buildings must be fireproof or fire-retarding types. The municipal building code, which has been under revision and discussion for the past ninety days, has not yet been adopted and doubtless will cause many protests from prospective cheap builders. The board of insurance underwriters and a committee from the Engineering Association of the South are acting in an advisory capacity in preparing the new code.

Panama Canal Opened April 15

After being closed to traffic for nearly seven months the Panama Canal has been cleared of obstructions and was opened April 15. A vast amount of material has been removed and the canal at the cut at Culebra has been widened 300 ft. for a distance of ¼ mile and dredged to a depth of 35 ft.

Plans Prepared for Houston, Tex., Sewage Disposal Plant

E. E. Sands, city engineer of Houston, Tex., has completed plans for the installation of sewer systems and disposal plants using the activated sludge method, for which $1,000,000 bonds were issued. The area required will be small and the plants can be built just above the high water level of the channels along which they are located. The pumping heads will be reduced to a minimum and the construction cost plus the capitalized operating and maintenance expense will be less than for any other method investigated.

The north side plant will consist of four and the south side plant of two units. Each unit is capable of handling the sewage for 37,100 people or an average flow of 2190 gal. per minute, or a maximum flow of 2680 gal. per minute. The average detention period in the aerating tanks will be 110 minutes and the minimum period 90 minutes.

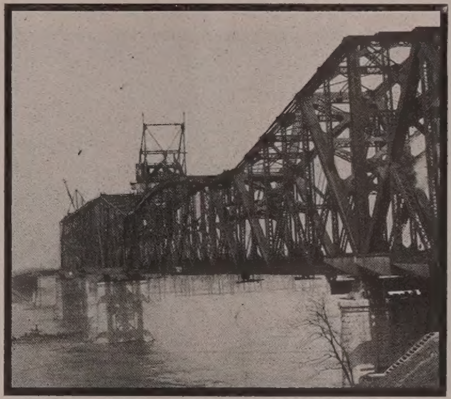
The north side plant has been designed to accommodate an average overflow of 12,600,000 gal. per day with a minimum flow of 8,750,000 gal. per day and a maximum of 15,400,000 gal. per day. The south side plant has been designed to accommodate an average flow of 6,300,000 gal. per day, a minimum of 4,375,000 gal. per day and a maximum flow of 7,700,000 gal. per day.

The power house at each disposal plant will be equipped with high pressure blowers. At the north side disposal plant, three blowers will be installed, each capable of delivering 3750 cu. ft. of air per minute measured under a pressure of five pounds. Two of these blowers will answer all requirements. At the south side plant two blowers of the same capacity will be installed.

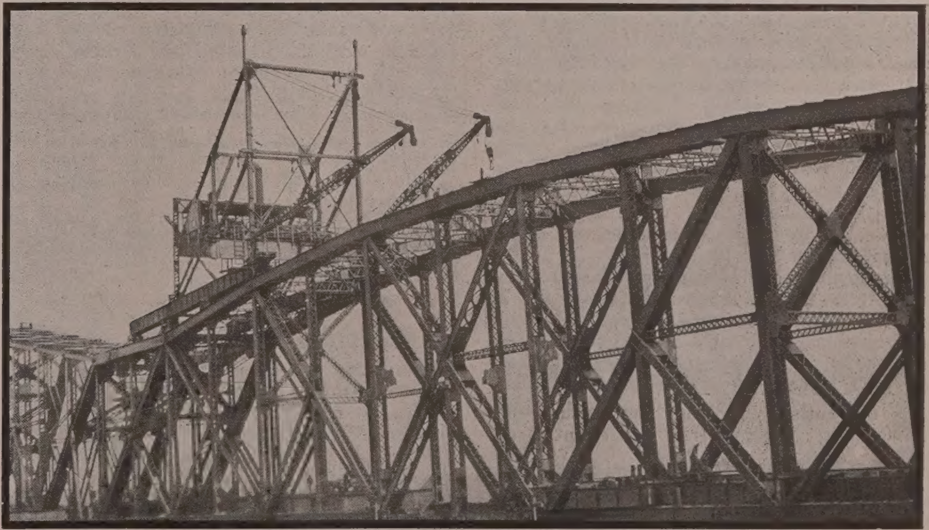
The estimated cost of disposal plants and pipe lines is $639,000 and the operating cost is given as $61,939 per annum.

All Spans of Memphis Bridge Closed Except One

Progress on the erection of the new Harahan bridge over the Mississippi River at Memphis, Tenn., for the Arkansas & Memphis Railway Bridge & Terminal Company, has proceeded until the superstructure is now practically complete, except the semi-supended and cantilever span between piers 3 and 4. The falsework for this span was washed out last December, as described in the Engineering Record of Jan. 8, page 62.


CANTILEVER ARMS AND SUSPENDED SPAN—FIXED SPAN ON LEFT

The accompanying photographs show the appearance of the structure early this month. The 418-ft. suspended span and the erection traveler are clearly seen, indicating the size and nature of the trusses. The cantilever arms are 186 ft. long and the fixed span in the distance (between piers 2 and 3) is 621 ft. long. A general description of the structure will be found in the Engineering Record of Nov. 8, 1913, page 516. Ralph Modjeski, of Modjeski & Angier, consulting engineers, of Chicago, designed the structure, which is being fabricated and erected by the Pennsylvania Steel Company, of Steelton, Pa.


ERECTION TRAVELER RETURNING AFTER CLOSING SUSPENDED SPAN

$10,000,000 Voted for Construction of New York Highways

A bill appropriating $10,000,000 for state highway construction was passed by the New York Senate April 15 and now goes to the Governor for approval.

Forty-Two Societies Represented at Chicago Conference

Second Convention on Engineering Co-operation Discusses Publicity of Engineering, Employment and Legislation

A chance to hear how the "other" engineering society is effectively serving its members, fulfilling its obligations to the public and actually working out its destiny were the main features of the second conference of the Committee on Engineering Co-operation, held in Chicago April 13 and 14. Little action was taken beyond asking a sub-committee, with Prof. F. H. Newell as chairman, to bring in, at a future conference, a plan for promoting co-operation among engineering societies in matters of general interest to the engineering profession.

The preambles stated that existing agencies through lack of proper correlation appear inadequate for the solution of these problems and in order that the resources of the profession may be made available for the most useful service to the nation, state and municipality, and that the practice of engineering may be rendered more efficient and less burdensome in those places where its development has been most difficult; and that it is the sense of the second conference on engineering co-operation —representing national, state and local societies, and comprising various branches of engineering—that these ends may be attained through a closer association and co-operation of engineering societies.

Twenty short papers on co-operation and relations between national, state and local societies were presented at the five sessions. In the three-minute talks on the organizations they represented, delegates became quickly acquainted with the problems and successes of forty-two societies.

Local Co-operation Demands Inclusive Membership

Willard Beahan of the Cleveland branch of the American Society of Engineers, believes in close co-operation among the local sections of the national societies in any one center. Meetings should not be held separately, nor should separate journals be published. Joined, they are a more effective body for civic betterment. Snags arise when any attempt is made to co-operate with other cities, as under present rules the correspondence must go through the home office, where so much time is lost and tape unwound that interest is killed.

John Howe Peyton, president of the Nashville section of the Engineers' Association of the South, could see no insuperable difficulties to overcome. "Find the right man to take the lead and give him unlimited support," was his proposal.

Paul Hansen described an ideal plan for state and municipal societies, whereby civic duties and influence in matters of legislation would register with more force.

J. W. Woermann of the St. Louis Engineers' Club outlined the rise and fall of the disbanded Associated Engineering Societies organization, and mentioned the four national society sections which are closely co-operating in St. Louis. The adoption of a standard boiler specification is one of their latest achievements.

Cleveland Gets Publicity

C. E. Drayer, secretary of the Cleveland Engineering Society, presented many illustrations of the devious ways by which publicity of engineering is obtained in newspapers. Editors cannot keep real news out of their columns, and it is simply up to the engineering societies to pick, or develop, a man who knows news when he sees it.

The Cleveland engineers are planning an initial copy of a popular, profusely illustrated engineering magazine modeled after the *National Geographic Magazine.* Other societies and individuals having interesting photographs are asked to join in the effort to produce such a journal.

Minnesota Has Found the Way

George H. Herrold, president of the Civil Engineers' Society of St. Paul, told the story of the latest example of local co-operation. He stated that the first thing was to get engineers acquainted with the Minnesota Joint Engineering Board. They found the weekly lunch was the best means, but at first men did not even want to eat together. They apportioned the list among those most interested with poor results, and finally, by getting young ladies to do the telephoning, the luncheon attendance was increased to fifty engineers. They feed the speaker first, and he talks while the remainder eat. In the summer inspection visits, automobile trips and even house parties have resulted in making the "engineer become a little more human."

H. J. Burt, chairman of the committee on legislation of the Western Society of Engineers, which obtained the Illinois structural engineers' license law, outlined the duties of the engineering society in legislative matters.

Contractors Want Concerted Action

"The Engineer and the Contractor" was the subject of a talk by DeWitt V. Moore, who represented the American Society of Engineering Contractors, which association was organized to get co-operation of all interests concerned in completing a structure. He also discussed the proper way to handle a society publication and mentioned that his organization had turned over the publication of its journal to outside parties. A joint committee to standardize specification clauses was of the greatest moment, in his opinion.

"Employment of the Engineer" was the topic assigned to Arthur Kneisel, secretary of the American Association of Engineers. In his opinion, it is rank foolishness to talk professional ethics to the man whose family is suffering for the lack of necessities of life. The object of the association is to raise the standards of ethics of the profession, he said, but since it could not talk ethics to the hungry man it proceeded to feed him and put him in touch with work. About 250 men have been served in six months, at an estimated total saving to them of $7,500. Twenty branch service clearing-house offices are contemplated when the membership will warrant the expense.

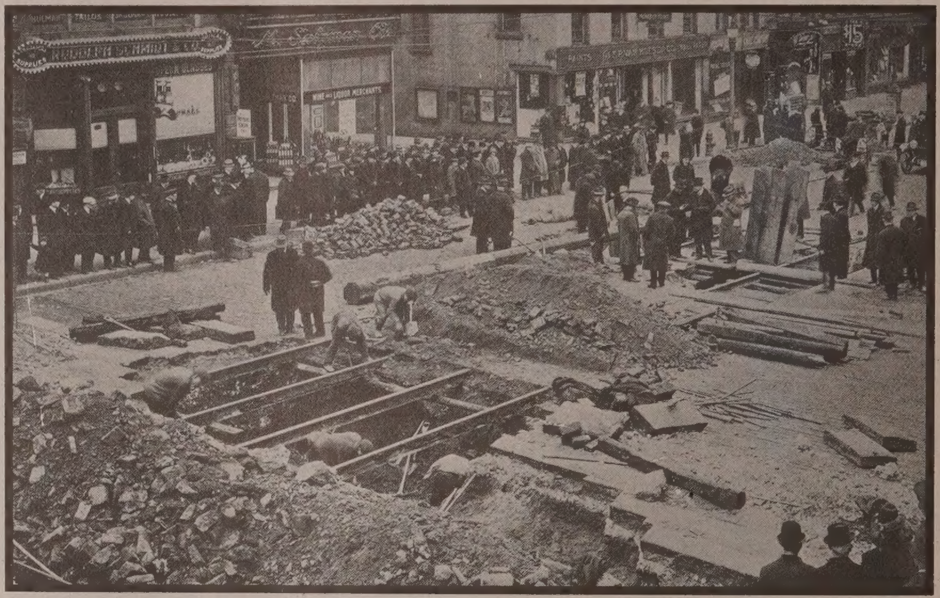
The co-operation of the St. Louis Engineers' Club for handling this function in St. Louis is under contemplation and any method which experience and wisdom may suggest will be gladly entered into with any other organizations, said Mr. Kneisel.

Stone Pavement in Rochester Undermined by Flood

Maximum high water in the Genesee River at Rochester, N. Y., recently caused the collapse of 12 sq. yd. of the Medina block stone pavement, with its concrete base, at a point a little south of the car track and west of the Main Street bridge, which was indicated on a map on page 477 of the issue of April 8. The pavement caved in to a depth of 10 ft., as shown in the illustration.

The washout was apparently due to the existence of an abandoned stone sewer 3 ft. 9 in. wide and 5 ft. 3 in. high, which was constructed in 1832 and superseded in 1863.

The water from the river, which at the time stood about 5 ft. above the top of this sewer, entered it either through, or under, the present bridge abutment, or between the present and a former buried bridge abutment.



SHOWING THE COLLAPSE OF PAVEMENT IN ROCHESTER, N. Y.

The water broke through an old egg-shaped sewer 1 ft. 9 in. x 2 ft. 6 in. and entered an existing sewer manhole west of the bridge 18 ft. below the surface. Flooding of cellars might have resulted had not the new sewer tunnel, 8 ft. square and 40 ft. below the surface, been sufficiently completed so that connections with the existing sewer were made. The only inconvenience occasioned has been the closing of Main Street to street car traffic, during which time the local trolley company has taken occasion to renew its tracks in this locality. An investigation of the river end of the abandoned sewer will be made when the water lowers.

The information and photograph were supplied by John F. Skinner, principal assistant engineer of Rochester.

Offer Prizes for Pictures of Good or Bad Roads

For the purpose of establishing in Washington a national exhibit on good roads problems, prizes to the amount of $2,600 have been offered by the National Highways Association for pictures of good and bad roads. The contest will close at noon Nov. 7.

There will be 166 prizes in all ranging from $500 down to $5. Competitors may submit as many photographs as they desire and will not be limited to one prize, each picture being judged upon its own merits regardless of the person from whom it came. The judges of the contest are Theodore Roosevelt, Ida M. Tarbell and Mark Sullivan. The money was subscribed by Gen. T. Coleman du Pont and Charles H. Davis, president of the association.

Civilians Who Worked on Panama Canal Want Bonuses

Approximately 5000 men who helped build the Panama Canal are reported to have organized to support a bill in Congress which will provide for recognition of civilians employed in building the Canal in some manner commensurate with Congressional recognition of army, navy and public health officers.

According to the statement issued by the Panama Canal Employees' Association, civilians were unjustly ignored when bonuses were distributed by Congress. C. O. Simmons, chairman of the committee representing the association, is quoted in the statement as indorsing the bill, which asks for the appropriation of $9,000,000 to be applied as bonuses for the civilian employees.

Major-Gen. Goethals is said to be in favor of the movement.

Texas Engineers Will Fight Cameron Septic Tank Company

Prominent engineers in Texas are opposing the contentions of the Cameron Septic Tank Company that royalties are due them on processes used by disposal plants in 75 towns in that state. The state sanitary engineering department has been urged by many of the municipal officials to form an organization for defense of the claims made against their respective cities and towns.

The alleged royalties will, it is believed, influence the progress in sewage disposal matters in that state. V. M. Ehlers, state sanitary engineer, has requested a number of the prominent engineers of Texas to advise him as to their position in the matter, predicated on articles that have appeared recently in engineering papers.

His answers have always been against the allegations of the Cameron Septic Tank Company.

Mohansic Water Bill Passed by New York Senate

At the April 17 session of the New York Senate the Mohansic bill, providing for a commission of three to negotiate the removal of the Mohansic State Hospital for the Insane and the New York State Training School for Boys from the Croton watershed, was passed by a vote of 30 to 10.

Senator Wagner's amendment, which would give positive assurance of the removal of the institutions from the Croton watershed, was killed.

Civil Engineers Discuss Local Section Co-operation

Officers of Other National Bodies as Guests Give Experiences of Their Societies with Branch Organization

Co-operation between national engineering societies and their local branches, and between these local branches and local engineering societies or clubs was the theme that officers of the other national societies were invited to discuss at the meeting of the American Society of Civil Engineers in New York, April 19. W. L. Saunders, past president of the American Institute of Mining Engineers; Paul M. Lincoln, past president of the American Institute of Electrical Engineers, and D. S. Jacobus, president of the American Society of Mechanical Engineers were the guests of honor. The president of the American Society of Civil Engineers, Dr. E. L. Corthell, was prevented by illness from attending.

Dr. Corthell dictated a letter, however, in which he outlined the form of organization he deemed necessary to knit the whole profession together. First, there should be a conference committee of the national societies and then local joint committees in each large center of population. The national and local committees should be in constant communication.

Experience with Sections

Mr. Lincoln, speaking from an experience with sections going back over ten years, advocated the greatest possible autonomy for local branches of national bodies. In this view he was emphatically indorsed by Mr. Jacobus and some of the later speakers. The American Institute of Electrical Engineers now has thirty-two sections, and appropriates annually a sum varying with the membership to help pay the expenses of the section. The institute pays the expenses of a delegate from each section to the annual meeting. Mr. Saunders later explained that the mining engineers do this also.

Mr. Jacobus gave some details of section management in the mechanical engineers' society, and emphasized especially the good derived from the forty student sections. He declared that the national societies must look after the young men, bringing them in early and preparing them to carry forward the high ideals of the profession.

In the mining engineers' society, Mr. Saunders explained, sections are formed not only on geographical but also on technical lines—the anthracite specialists in one, the metallurgists in another, etc. Though their first sections were established only five years ago, the benefits have already been very great.

Each of these first three speakers advocated strongly co-operation between local branches in each population center, saying that it was the policy of their national bodies to encourage such joint work. The details of the co-operative plans at Chicago, Boston, Philadelphia, Atlanta and St. Louis were explained.

Following these specially invited speakers there were excellent discussions by the following members of the American Society of Civil Engineers: Charles D. Marx, past president; J. F. Coleman, director; F. G. Jonah, director; Daniel Bontecu, vice-president; George F. Swain, past president, who pointed out the importance of keeping the moral and ethical sides of professional work constantly in mind; H. S. Crocker, director, and John Bogart, formerly secretary and a director of the society. Clemens Herschel, vice-president, presided.

Demand for Engineers Increases

According to announcements by the faculty of Pennsylvania University, increased industrial activity has created an unusual demand for trained engineers. Most of the seniors at that college are reported to have arranged for positions which they will occupy after graduation and over fifty desirable jobs are advertised on the bulletin boards.

Board of Direction Acts on Ockerson Letter

As noted in the Engineering Record of April 8, page 495, the Philadelphia association of members of the American Society of Civil Engineers on April 3 asked the board of direction to state officially whether the society would surrender its autonomy in favor of the United Engineering Society in case it were determined to remove headquarters to the Engineering Societies' Building. Statement that it would so surrender its autonomy in affairs of a public nature had been made by Col. John A. Ockerson. The board at its meeting April 19 adopted the following resolution: "Voted, that there is nothing in the constitution or management of the United Engineering Society to warrant the assertions [those of Colonel Ockerson] above quoted. The United Engineering Society is the equivalent of a board of trustees created by the three Founder Societies occupying the Thirty-ninth Street building, of which this society has been invited to become a fourth, and was created and is carried on for business purposes connected with the management of the real property and libraries of the Founder Societies."

American Society Speaks on Constitutional Changes

In order to learn the sentiment of the members, the committee on revision of the constitution of the American Society of Civil Engineers recently sent out an inquiry on six points under discussion. The vote on these was canvassed at the meeting of the committee April 19 and the result announced at the meeting of the society on the same day.

Approximately 3150 ballots were cast. The sentiment was against the admission of women, by a small majority. The vote stood 85 per cent in favor of giving the board of direction the power to discipline and expel members, while on the formation of a new grade for salesmen the vote was equally decisive, but in the negative direction—that is, the members were opposed to such a grade. The proposal to raise the requirements of admission was defeated by a close vote. The establishment of some form of district organization was indorsed by 85 per cent of those voting. The final question—whether the duties of a professor of engineering should be considered equivalent to practice "in responsible charge of work," as a basis for admission or of transfer to a higher grade, was answered in the negative. The vote, however, was close.

News of Engineering Societies

The Utah Society of Engineers held an annual banquet April 19 at Salt Lake City, at which Dr. W. C. Ebaugh, formerly of the University of Utah, was toastmaster.

The Engineers' Society of Western Pennsylvania held a meeting April 18, at which Isham Randolph, consulting engineer, of Chicago, discussed the necessity for a national department of public works.

The Atlanta Section of the American Society of Civil Engineers has elected the following officers for the year 1916: President, Paul H. Norcross; vice-presidents, V. H. Kreigshaber and William C. Spiker; secretary-treasurer, Prof. Thomas P. Branch.

The Canadian Society of Civil Engineers, at a meeting held in Montreal April 13, heard John Murphy give an informal description of his recent trip over the Panama Canal. Lieut.-Col. F. A. Snyder described an original diagram for making military scales for interpolation of contours and reduction and enlargement of maps.

The Boston Society of Civil Engineers held a meeting last evening, at which Dr. Alexander C. Humphreys, president of Stevens Institute of Technology, read a paper on reform and regulation of public service utilities. The board of government submitted a report relating to permanent bench marks in Boston and the vicinity.

The Engineers' Club of St. Louis heard Major Wildurr Willing, Corps of Engineers, U. S. A., deliver his third lecture on military engineering April 19. Major Willing devoted his time to a discussion of the duties of engineers with the mobile army in the zone of the advance. Carl Gayler gave a short lecture from the standpoint of the civilian engineer on trenches.

The Society of Engineers of Eastern New York held a meeting at Albany April 12, at which the following officers were elected: President, John E. Yorkston, Schenectady; vice-president, Lewis F. Moody, Troy; treasurer, Edgar Croasdale, Schenectady; member of finance committee for three years, Charles H. McCulloch, Albany; member of executive committee for three years, George E. Conlee, Amsterdam.

Personal Notes

BERT E. ANDERSON has left the engineering department of the Pennsylvania Railroad to enter the employ of the Standard Steel Car Company at Butler, Pa.

J. E. SHOEMAKER, who recently resigned as principal assistant engineer of the Port of Seattle Commission, has formed a partnership with Peter Swanson and entered the general contracting field.

PAUL GENDELL, manager of the Engineers' Society of Pennsylvania, Harrisburg, Pa., and editor of the journal of that society, has resigned to become secretary of the Dubois (Iowa) Chamber of Commerce. Mr. Gendell came to Harrisburg eleven years ago and, with the exception of one year, when he was with the Missouri Pacific Railway Company as assistant engineer, was connected with the engineering department of the Pennsylvania Steel Company bridge and construction plant at Steelton, Pa., until his association with the engineers' society a year ago.

LYMAN GRISWOLD, of Portland, Ore., has been appointed assistant engineer on the engineering investigations connected with the Ochoco Irrigation District, near Prineville, Ore. He will be principal assistant to R. W. Rea, in direct charge of all field parties and investigations. Mr. Griswold has had extensive experience in railroad construction, especially on the Oregon Trunk Railway from Fallbridge, Wash., to Bend, Ore., as well as in irrigation work in the West.

L. L. KELLY has been promoted from the position of resident engineer for the Norfolk & Western to that of assistant engineer, with headquarters at Norfolk, Va.

WILLIAM P. WILTSEE, assistant engineer for the Norfolk & Western, has been transferred from Norfolk, Va., to Roanoke. He has been in the employ of that road since 1901, during which time he has risen from the grade of transitman to that of assistant to the construction engineer, in responsible charge of work relating to new lines.

C. S. FISHER has accepted a position with the Lanowe Construction Company, of Detroit, as civil engineer in charge of construction of a new beet sugar plant being constructed in that city.

N. C. GROVER, chief hydraulic engineer in the water resources branch of the United States Geological Survey, has recently returned after a two months' visit to the Hawaiian Islands and the Pacific Coast.

CLIFFORD B. MOORE, consulting engineer, of New York City, has been appointed a member of the examining board of city surveyors to succeed E. P. Goodrich, whose resignation was noted in the issue of April 8.

J. W. Stanchfield, contractor, of Seattle, Wash., will remove his business to Astoria, Ore., where he will engage in general contracting work.

Raymond L. Gebhardt has been promoted from the position of division engineer for the Lehigh Valley Railroad, at Easton, Pa., to that of trainmaster of the Seneca division, with headquarters at Hazleton, Pa.

G. R. Solomon, of the firm of Solomon-Norcross Company, drainage engineers, of Atlanta, Ga., has been appointed a member of the board of directors of the organization for industrial preparedness. The appointment was made by Josephus Daniels, Secretary of the Navy.

N. F. Thompson, engineer of grade crossings of the New York Central Railroad at New York, has been appointed assistant district engineer for the New York district, with headquarters at New York. Mr. Thompson is a graduate of Rensselaer Polytechnic Institute, class of 1907. Prior to graduation he had been in the employ of the New York Central, and after graduation he remained there, in the office of the engineer of grade crossings, first as draftsman and later as assistant engineer. Late in 1909 he was appointed assistant engineer of grade crossings, and in the spring of 1912 he was advanced to the position he has recently left.

E. S. Voorhees, assistant engineer in the office of the engineer of grade crossings of the New York Central Railroad at New York, has been appointed engineer of grade crossings, succeeding N. F. Thompson, promoted as noted elsewhere. Mr. Voorhees was graduated from Yale University in 1907. Following graduation he entered the employ of the New York, New Haven & Hartford Railroad, where he remained for a year and a half. Late in 1908 he began his service with the New York Central in the maintenance-of-way department at Albany. After about six months he went over to the engineering department as inspector at Watertown, N. Y. Three years later he returned to Albany as assistant engineer, where he remained only a few months, until about the middle of 1912. He then came to New York to the office of which he is now made head.

G. W. Knight and L. A. Quale have opened an office in Chattanooga, Tenn., to engage in the practice of sanitary and hydraulic consulting engineering. Mr. Knight was formerly assistant engineer to R. Winthrop Pratt, consulting engineer, of Cleveland, and Mr. Quale was recently connected with the Cleveland waterworks department. The firm has been retained by the "Twin Cities" of Bristol, Va.-Tenn., to report on the water supply resources, and in addition, will prepare a report on water supply, sewerage and pavements for Newport, Tenn. The firm has also been retained by Florence, Ala., to oversee the construction of a filtration plant to be erected by day labor.

F. E. Weymouth, whose appointment to the position of engineer of construction for the U. S. Reclamation Service, with headquarters at Denver, Col., was mentioned in the issue of Feb. 12, recently made a trip to Yuma, Ariz., to look over that project. He was accompanied by L. M. Lawson, manager of the Yuma district.

Clyde Aitchison has resigned from his position as chairman of the Public Service Commission of Oregon to accept an appointment as solicitor for the National Association of Railway Commissioners, in which capacity he will represent the state commission in connection with the valuation of railroads being made by the Interstate Commerce Commission. His headquarters will be at Washington, D. C. Mr. Aitchison has been a member of the Oregon commission since 1907, and previous to then was secretary of the Oregon Tax Commission appointed to redraft the state tax laws.

Capt. Stuart C. Godfrey, Corps of Engineers, U. S. A., delivered a lecture Friday, April 14, before the members of the newly formed volunteer engineer corps at the Massachusetts Institute of Technology. His subject was "Duties and Organization of Engineer Troops" and lantern slides, furnished by the government, were shown.

S. E. Barnes, formerly manager of the general contracting department of the R. T. Ford Company, has accepted a position with the New York Central Railroad in the valuation department, in charge of valuation of buildings.

Rankin Duval, a graduate of the engineering department of the University of Kentucky, has been appointed road engineer for the construction of the $100,000 bond roads in Scott County. His headquarters will be at Georgetown, Ky.

Clyde T. Morris, professor in the engineering department of the Ohio State University, represented the Ohio Engineering Society, of which he is president at the conference on engineering co-operation held April 13, in Chicago.

Frank R. Lanagan, city engineer of Albany, N. Y., was the principal speaker at the meeting of the Whitehall Section Improvement Association, held April 14, in that city.

Thomas K. Mixler has resigned from his position with the T. A. Gillespie Company, of Pittsburgh, to become connected with the American Bridge Company, at Gary, Ind. Mr. Mixler is a graduate of the engineering department of the University of Pittsburgh.

James F. Donovan has been appointed to succeed R. L. Gebhardt as division engineer of the Lehigh Valley at Easton, Pa.

Edwin D. Hayward, B. S., Massachusetts Institute of Technology, at present associated with the faculty of De Pauw University, will soon assume his duties at the University of California, as instructor in civil engineering.

Paul H. Gilbert has been promoted to the position of transitman for the Pennsylvania Railroad with headquarters at Reading, Pa.

Frank McLaughlin, who for the past few years has been connected with James Stewart & Company, has resigned his position with that company to accept one with the Foundation Company, as superintendent in charge of the erection of a chemical plant for the Eastern Manufacturing Company, at South Brewer, Me. Mr. McLaughlin was graduated from the London Polytechnic College, of London, England, in 1905. During the construction of the Pennsylvania Railroad tunnels he was superintendent of concrete construction on tunnels under the East River, New York City. His last work with James Stewart & Company was as superintendent of construction of the Bridgeport plant of the Remington Arms & Ammunition Company.

A. W. Walker has been appointed engineer on the drainage system for the Grand Valley drainage district, with headquarters at Grand Junction, Col. He will have charge of surveys investigations, plans and estimates for that system.

Charles P. Light has severed his connection with the American Highway Association as field secretary, and will associate himself with the Fidelity Mutual Life Insurance Company, of Philadelphia, in a managerial capacity, May 1, with headquarters at Washington, D. C.

H. W. Lewis, who has recently had charge of surveys and construction for the Standard Oil Company of New York, in Columbia, South America, is now superintendent of construction in charge of concrete jetty work being done by the state of New Jersey at the Shark River outlet, at Belmar.

T. L. Bradford, who recently resigned from his position as bridge designer with the New York state barge canal, has accepted an appointment with the American Bridge Company, with headquarters at Ambridge, Pa.

August E. Hansen and Waldo S. Coulter announce that they have formed the firm of Hanson & Coulter, hydraulic and sanitary engineers, with offices at 2 Rector Street, New York City. It is the purpose of the new firm to act as designing, consulting and superintending hydraulic and sanitary engineers in water supply and water purification, water power development, sewerage and sewage treatment, sanitation of buildings, garbage disposal and river improvement. Mr. Hansen is a graduate in sanitary engineering of the Massachusetts Institute of Technology, class of 1902, and has been associated for the past nine years with Lederle & Provost of New York City. During this time he has had complete and direct charge of numerous projects in the water and sewerage field. Previous thereto he was five years assistant engineer with Andrew D. Fuller, consulting sanitary engineer, of Boston, Mass.; treasurer of the E. M. Porter Plumbing & Heating Company, Springfield, Mass.; principal assistant engineer with Paul Gerhard, consulting sanitary engineer, of New York City, and engineer in charge of construction with Williams, Proctor & Potts, consulting and contracting hydraulic and sanitary engineers, New York City. Mr. Coulter has been associated with Lederle & Provost for the past five years, in charge of hydraulic and sanitary work for municipalities, corporations and estates. During about three years of this time he was in Argentina, where he conducted tests, prepared plans and constructed treatment works for slaughter house, wool scouring and tannery wastes in Buenos Aires. Previous to this he was for four years on the design and inspection of work on the N. Y. State Barge Canal. During seven years Mr. Coulter was employed by the Metropolitan Water and Sewerage Board of Massachusetts upon a variety of work related to water supply, highways, sewers and sewage treatment.

John R. Graham, for the past five years general foreman of the street and sewer departments of Lynn, Mass., has been elected commissioner of streets, to succeed the late George M. McPhetres. The new commissioner was born at Lynn fifty-two years ago and is an expert road builder.

Obituary Notes

Emery J. Kerrick, until recently employed in superintending the development of the Morris and Gerhard estates in Philadelphia, died recently in St. Petersburg, Fla., at the age of 54. Mr. Kerrick was born in Frenchtown, Pa., and was graduated from the Susquehanna Collegiate Institute, at Towanda, in 1887. After teaching school for a year, he entered Lafayette College in 1888 and was graduated from the engineering department in 1891. For one year immediately following his graduation, he was employed in the bridge department of the Lehigh Valley Railroad, after which he became assistant engineer in charge of the construction of the Reading terminal, in Philadelphia. He resigned this position to become associated with Chester E. Albright, civil engineer, of Philadelphia. In 1897 he engaged in business for himself and from this time until his death he had been continuously engaged in engineering and contracting work. He executed several large contracts for the Philadelphia Rapid Transit Company, among them being the work at the Sixty-ninth Street terminal and the construction of a street railway from Chelton Avenue to the city line. He also executed a number of important contracts for Philadelphia.